

The arte

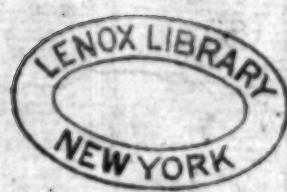
of Navigation,

Conteyning a compendious
description of the Sphere, with the
makyng of certayne Instrumentes
and Rules for Navigation: and
eremplified by many Demonstrati-
ons. Written in the Spanishe
tongue by Martin Curtes,
and directed to the Em-
perour Charles
the fyfth.

Translated out of Spanishe
into Englyshe by Richard
Eden, and now newly
corrected and amen-
ded in dyuers
places.

1572.

R. I.



To the ryght worshypfull Syr Wylliam
Garerd Knyght, and Maister Thomas Lodge,
Aldermen of the Cite of Londen, and Gouvernours of the hono-
rable felowshippe or societie, as well of certayne of the
Pabilitie, as of Marchauntes aduenturers, for the
discouerie of Landes, Territories, Ilandes,
and Seignories unknowen, and not
before theyr first aduenture or en-
terprise by Seas or Sauiga-
tions commonlye ser-
quented.

And to the ryght worshipful the Consulles,
Assistentes, and Comminaltie of the
same societie, Richarde Eden
Wyslheth health and
prosperitie.



Wat so ever he was (right hono-
rable and worshipful) that first
beleueld that the frame and co-
aptation of the bodye of man,
with the functions, offices,
and dutties, of the partes and
members of the same, knitte to-
gether in a certayne vnitie to a
common ministracion, byd re-
present a lyuely image and similitude of a perfect common
wealth: I thynke that he was a man of no vulgar iudgement,
or abiecte minde, but rather of singuler wisedome
and prudence in the contemplation of diuine and humane
thynges. For he sawe, that as in the small natuare seede
of all growyng or lyuyng thynges, is contayned the
fourme that bringeth them to their perfection: so in cer-
tayne small and obscure members of the common wealth,
consisteth no small increase to the perfection of the whole.
He sawe lykewyse that herein, as in the bodye of man,
representyng the partes and members of the worlde (as
I haue sayde) are diuers partes of diuers and sundrye

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actions & motions, greatly differing in forme, number, and quantitie, yet all the same to be so knytte togeather, and so to consent in one vniuermite, to the common profit of the whole, that a greater concorde and harmonie can not be imagined, then is proportioned by the freendely vnitie of diuers and contrarie. He saue lyke-wyse in the same, such a mutuall compassion of parte to parte, and member to member, by one common sense ex-istent in them all, that no one parte or member can feele eyther sore or Payne, but that in manner all the other are partakers thereof more or lesse, yf they be lyuelye mem-bers, and not wythered, or otherwyse vn sensible by rea-son of dead fleashe, which onely by cuttyng and burnyng ought to be diuided from the sounde and whols. But as in man (whom Plato calleth the lesse worlde) the vigour and agilitie of the immortall soule and mynde, never ceaseth from continuall moouyng, but is euer exercised in excogitations and inuentiones of greate thynges (here-in resemblyng God, whose carakte it beareth) by prouid-ence foreseeing, and by intelligence vnderstanding, and deuising what is to be donne, and what to be eschewed, doeth immediatly mooue and rayse by the faculties, pow-ers, and members of the bodye to execute the same: Euen so, in the greater worlde, the prouidence of God, and vni-uersall counsayle and consente of menne, hath elected and appoynted certaine principall menne, to beare like rule and auctoritie in the bodye of the common wealth, as hath the intellective soule in the members of our bodye to mooue and commaunde the same. To Princes therefore, Counsaylours, Rulers, Gonernours, and Magistrates, as to the most intellective and sensitivie partes of the societie of menne, hath God and nature geuen preeminence and gouernance of the common wealth, that by theyr prouid-ence, wisedome, and ayde, it maye vniuersally floxish, not onely by juste administration of good lawes, with due correction of malefactours, but also by liberall rewarayng of suche as haue well deserved: and especially by maynteynaunce of suche artes and sciences, as the common

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common wealth can not well be without. And to drawe
nearer to the applying of my similitude : I say, that
what so euer vertue, what so euer art, or the ingenions
industry of menne, hath to this day inuented, all the same
is to be imputed to the beneuolence and liberalitie of
suche as haue honourably maynteyned and freelys re-
warded the trauayles, paynes, and charges of them that
haue spent their liues, goodes, and wittes (as ma-
ny haue donne) in the inuention of necessarie and pro-
fitable artes and sciences. For even as wholesome and
temperate ayre, with seasonable weather, and fauourable
influence of the heauens and planettes, causeth fruiteful-
nesse on the earth, and contrarywyse, barrennesse by the
contrary : Even so the fauour of Princes and Magistra-
tes, nourisheth, augmenteth, and amplieth, all artes and
sciences by liberalitie, and extinguisheth the same by
miserable couetousnesse and parcimonie. And although
in some menne of rare and noble nature, the desyre of ho-
nor and fame onely for vertues sake, and studie towards
theyr countrey and common wealth, hath moued them,
in manner to theyr owne vndooyng, through theyr great
losse and hynderaunce, to set forth and inuente divers
thynges for the commoditie of the common wealth and
other, rather then for theyr owne: yet undoubtedly, who
so wel consydereth, and indifferently wayeth that I haue
sayde, shall synde and see by dayly experiance, that in
manner onely munificence, liberalitie, and rewarde, or
the hope therof, geueth spurres to them that attempte
great and vertuous enterpryses, as I coulde more large-
ly prooue by so many testimonies of Histories, both holye
and prophane, that the rehearsall thereof shoulde be but
tedious, and not greatly necessarie for my purpose,
especially wrytyng vnto your honours and worshypes,
of whose munificence and liberalitie, I haue had greate
experiance, both in my selfe, and others, who by yone
ayde and maynteynaunce, haue attempted, and perfo-
med many goodly inuentions, viages, navigations, and
discoueries of Landes and Seas, heretofore unknownen.

Wherin,

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Whererin, what greate charges you haue susseyned, and
howe liberal and constant you haue ben in furthering the
same, doth wel declare that hytherto you are rather losers
then gayners thereby. The whiche thyng doubtlesse, is
the more to your commendation, in that it may hereby ap-
peare that you haue attempted the same, rather for know-
ledge and vertues sake, then for covetousnesse of gaynes:
as is furthermore well knownen by your syrke viages of
discouerie attempted to Cathayē, by the North east seas,
vpon certaine losse & detriment, for uncertayne hope either
of gaynes, or of any such way to be found, other wise then
by certaine likely conjectures: not much vnylike to the shy-
ning flowres of Marchasytes, whiche outwardely appea-
ring in mineral mountaynes, are signes & tokens wherby
is conjectured what metal is conteyned therin, & whether
the same is to be folowed or not. And although it some-
time so chaunce, that suche signes are fayleable, shewing
more in appearance, then they conteyne in substaunce: yet
are not such signes, tokens, or shewes to be contynned, but
rather earnestly to be folowed, for as much as it hath ben
often proued, & found by exerience, that by folowing the
same, haue ben found great and rich mynes of metalles: as
Georgius Agricola in his booke De rebus metallicis, doth
largely declare and proue by manye examples. But to
wryte at large what greate thynges haue proceeded of
small and obscure begynnynges, and in manner mere con-
jectures: it woulde so farre exceede the measure of an
Epistole or Preface, that it woulde rather increase to the
luste quantitie of a booke. For in manner all the late dis-
coueries both of the Spanyardes and Portugales, had
theyr begynnyng of suche small conjectures, with uncer-
tayne hope (as it were preter spem sub spe) vntill God
and good happe, by the constant trauayle and valiant
minde of such as first attempted the same, gaue them to en-
joye that they hoped for. But what so ever they haue ob-
tayned, and do enjoy, this may I boldly say in your behalfe
(right honorable and worshipfull) that there hath not lac-
ked in you eyther ylike or greater promptnesse of minde,
forward

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forwardnesse in attemptyng, magnificence in erpences, and liberall in rewardes. For besyde the great charges and losses that you haue ben at other wyse, what shoulde I speake of the great gystes that you haue sente to the Emperour of Russia? What of your last chargeable byage of discouerye among the innumerable Rockes, Ilandes, and mouable mountaynes of Ice in the frosen sea, by innumerable landes and Ilandes unknownen to the Antiques even vnder and farre within and beyondes the circle Artike, where they thought that no lyuyng creature coulde draine breathe or lyue for extreeme colde: whereas neverthelesse the same hath ben by you discouered, even vnto the myghtie ruer of Ob, that falleth into the Scithian Ocean, or Oceanus Hyperboreus, not farre from the mountaynes called Hyperborei, so named, because they are situate almost vnder the North pole, and thought therefore to be inaccessible. A byage doubtlesse of suche difficultie, and in maner impossibilitie, that consideryng the infinite daungers thereof (as I haue learned by thinfoximation of Steuen a Burrough, that was then the chefe Pilote of the same byage) it maye seeme impossible that they shoulde ever haue escaped, except the myghtie hande of GOD, by the expert skylfulness of so excellent a Pilote, had deliuered them from those daungers. And although in dede (as religion byndeth vs) it is conuenient in all thinges to geue all honour, glorie, and thankes to God, yet are we not thereby restrayned to be thankesfull to such men, as by theyr arte, ingenousnesse, trauayle, and diligence, haue deserued both iuste commendation and large rewarde. And therefore referryng the rewarde to you (ryght honorabile and worthypfull, to whom it apparteyneth) yf I shoulde not here geue hym at the leaste suche commendation, as in my iudgement he hath well deserued, I myght seeme both to defraude hym of his worthye deserutes, and also to forgette the scandlypp and good wyll I beare hym, onlye for his vertues and excellencie in his profession. For certaynely when I consider how indigent and destitute this Realme

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is of excellent and expert p'slottes, I can do no lesse of con-
science, then, in respect of your owne commoditie, yea ra-
ther for the commoditie of the Queenes Maiestie and the
whole Realme, to exhort you, & put you in remembraunce
(althoough I may herein seeme to put the spurres to a run-
ning horse, as saith the Proverbe) so to regarde hym, and
esteeme hym, and his saythful, true, and painful seruice to-
warde you, that he maye thereby be further encouraged,
and not discouraged, eyther for lacke of maintenaunce, or
otherwyse by the inturious assaultes of such his enemites,
as only his vertues and excellencie haue mooued to beare
hym displeasure, as envy doth ever folow vertue, as saith
the Latin Proverbe, Virtuti comes inuidia. And howe
true a sentence this is, is wel verifid by the saying of a
certayne Philosopher (whose name I do not remember)
who hearyng one bainely rejoyce that he had no enemites
aunswered, that that was a token he had done little good:
Meanyng thereby (as dayly experiance prooueth) that yf
he had excelled in any vertue, he coulde not haue lacked
some enemies. And having here touched to speake of en-
emie, I remember that when I was a yong scholer, I haue
read in the Poet Hesiodus of two kindes of enuite, where-
of the one is called Inuidia, and the other Aemulatio, whi-
ch is more tollerable then the fyre, for that it is toyned
with some vertue, and enuyeth that anye shoulde excell
hym in anye excellent qualitie that he professeth. But
soasmuch as this enuite of emulation proceedeth of some
singuler vertue of them that are so maliced, they maye
herein rejoyce, that they shall euer haue a hundred
frendes for one enemie: yea, and althoough they hadde
none, yet is vertue a rewarde to it selfe, and to be em-
braced for it selfe onlye, as the Philosophers affirme.
What then shall we saye to suche, as forgetting this re-
warde of vertue, do not onlye fauour, but rather bynder
the preferment and mayntenaunce of suche experte men,
more esteemyng certayne Fyshermen that go a traw-
ling for fishe in Catches, or Mongers, and Dradgies for
Dysters about the landes, betwene the South furlandes

and

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and Wlynterton nesse, and the sandes about Lemnes mouth, then they do suche excellent Pilotes as are able without any Rutter or Carde of Nauigation, not ony to attempt long and farre byages, but also to discouer unknownen landes and Ilandes, as haue donne of late yeres many excellent men, to the great honour and encychyng of theyr Prince and countrey. But as touching Hosten a Borrough, the cheife Pilote of your byages of discouery, it may hereby wel appere that he is neither malitious nor envious of his arte and science, in that he desyreteth the same, for the common profit, to be common to all men: and for the same intent was the first that moued certayne worshipful of your company, as syg: Willm: Garerd, Maister Willm: Mericke, Maister Blase Sanders, and Maister Edward Castlen, to haue this woorke translated into the Englishe tongue. Who of their owne good nature, sauouryng all vertuous studys and the professors of the same, dyd soone enline to his honest request herein: and therewith not only desyred me, but also with liberall rewards enterteyned me, to take in hande the translation. Whiche beyng nowe finished as well as my poore learnyng may perfourme, I desyre your honours, and worshyppes, to accept in as good parts as I haue moued herein to gratifie you, and do suche service as my a- bilitie may suffice. So wetherfore this woorke of the arte of Nauigation, beyng publyshed in our vulgar tongue, you may be assured to haue more store of skylfull Pilotes. Pilotes (I say) not Pirottes, Rulers, not Rovers, but such as by their honest behauiour and condicions, soyned with arte and experiance, may do you honest and true ser- vice: Whiche is not to be looked for of suche as beyng destitute as well of the feare of God, as of all morall vertues, superabounde in all notozous byces, accomptyng desperatenesse for boldnesse, rashnesse, for hardinesse, impudentie for stoutnesse, and crueltie for manhood. What other thyng (I saye) is to be looked for of suche, then of suche trees, such fruistes, Et mali corui, malum ouum. But for as muche as these haue no place appoynted them in

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the bodie of our common wealth, whiche we haue heretofore compared to the members of the body of man: theresoare they no otherwyse to be esteemed, then as excremente of the bodye, to whom nature hath appoynted no place in the same, but laboureth continually to cast them soorth dyuers wayes, least by theyr sylthyness they shold infect the other members, even as the pompe of the shippes, yf it be not annoyded, is noyous to the shippes and all that are therein. But the wyse and honest pylote, syrte hauyng before his eyes the feare of G OD, and puttynge his cheeke trusl in hym, shall secondarily trusle to his arte and science, without any such bayne obseruacions as the superstitious Horoscopers (Astrologiers I meane, and not Astronomers) are accustomed to vse in the elections of houres, tymes, and dayes, by constellacions and aspectes of the Starres and Planettes, as many sondre menne haue donne, thynkyng thereby to haue escaped such daungers, as they haue thereby the rather fallen into, through contempt of arte and science, by foolyshe confidence in superstitious Astrologie: which for the banishe and uncertaintie thereso, the ryght woosthipfull, and of singuler leaernyng in all sciences, say Thomas Smyth, in my tyme the flourre of the Universitie of Cambridge, and sometime my Tutor, was accusumed to call Ingeniosissimam arte mentiendi, (that is) the most ingenious arte of lyng. Omitting therefore the superstitious and phantasticall obseruacions of the Judicialles of Astrologie, it shalbe better and more necessary for all Pilotes that desyre to excell in theyr profession, to learne and obserue the principles of this booke, whereby they may haue suche knowledge of the Sphere, as maye instructe them the makynge and vse of dyuers goodlye Astronomicall instrumentes perteynyng to the arte of Navigation, by knowledge of the mouynge of the Sunne and Moone in theyr Spheres, and the other Planettes and firte Starres: therby to attayne to the true knowledge of houres, tymes, and tydes, with the variation of the Compasse, and many other goodlye naturall obser-

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obseruations of weathers, tempestes, and calmes, by certayne infallible signes and tokens of the same, very necessarye to be obserued, and this by the true principles of Astronomie, and not of Astrologie. And this is the true Astronomie, whereof the divine Philosopher Plato hath wrytten so divine a sentenc, that I haue thought the same here woorthe to be alleaged, that by the auctoritie of so famous an aucthour, we maye knowe what is true Astronomie, with the use and commoditie thereof. Therefor in his booke entituled, Timaeus vel De Natura, these are his wordes. Rerum autem optimarum cognitionem, nobis oculi attulerunt. Nam haec quæ de mundo disputantur, nunquam inuenta fuissent, si neque sydera, neque sol, neque Cœlum, suspici potuisset. Cognitio vero diei ac noctis, ab oculis orta, fecit ut dimensione quadam, mensum annorumque ambitus metiremur, tempus cognosceremus, ac vniuersæ naturæ ordinem scrutaremur. Quibus ex rebus, philosophiam adepti sumus.

That is to say, Our eyes haue brought unto vs the knowledge of moste excellent thynges. For what so ever is disputed of the worlde, had never benne inuented, yf neyther the Starres, neyther the Sunne, neyther heauens, coulde haue benne seene. For the knowledge of the daye and nyght, taking begynnyng at the eyes, caused vs, as it were by certaine limites and boundes, to measure the circuites of monethes and yeeres, whereby we came to the knowledge of tymes, and the order of vniuersall nature. And hereby also we obteyned the knowledge of Philosophie. &c. And thus by the auctoritie of divine Plato, (whom for his excellencie, Cleero called Deum philosophorum (that is, the God of Philosophers) we maye understande, that the true Astronomie, is the perfecte knowledge of the miraculouſe mouinges of the planettes, Starres, and heauens (and especiallye of the Sunne and Moone) whereby is caused the varietie of tymes, and diversitie of all naturall thynges, by naturall causes: as by the qualities of Elementes, as hotte, colde, moyste, and drye, whiche are augmented or diminished by the

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more or lesse influence of these two Luminaries, as they comme nearer vnto vs at sometymes, or de parte further from vs at other tymes, with diuers motions in diuers climates, whiche causeth not onely varietie of tymes in sundry climates, but also the varietie of diuers complexions, fourmes, and dispositions of all creatures vnder the face of heauen, none other accidentall contyngent, voluntarie, or violent cause, to the contrarie notwithstanding. And this is it that Plato meaneth by those woordes. *Vt tempus cognosceremus ac vniuersæ naturæ ordinem. &c.* That is, to knoyme the tymes and vniuersall order of nature. And doubtlesse, who so well consydereth the maruaylous effectes that are caused, especially by the variable mouing of the Sunne in the Zodiack, must needs acknowledge it to be the cheife instrumente & meane that God vseth in the generation, preservation, and alteration of all creatures that are conteyned in the woorlde, of generation and corruption. And for this consyderation, certaine of the ancient Philosophers called it the soule of the woorlde: Other, the eye, and other also, the heart of the woorlde. Plato also affirmeth, that the soule of the woorlde is in the Sunne: And that all other lyuyng thynges, receyue lyfe from thence. And hereof commeth the saying of the Philosopher, *Sol & homo, generant hominem;* (that is) the Sunne and man, begette man. And therfore (as wryteth Marcilius Ficinus) of all idolatres they are moste tollerable that honour the Sunne for God. The whiche, although it be not, yet vndoubtedly are his effectes so great and woonderfull in this inferiour woorlde, that it maye seeme in manner to be Gods Vicegerent, Lieutenant, and Viceroy in al the woorkes of nature, except where and when it pleaseth him in any thing miraculously, otherwyse then by the common order and course of nature, to commaunde the contrary.

And ys it may not be tedious vnto you (ryght honorable and worshipful) it shalbe a pleasure vnto me, for the better declaration hereof, to make a briefe discourse of the maruaylous and straunge effectes that are caused by the Sunne:

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Sunne: whiche perhappes sewe haue donne, otherwyse
then dispearsedly here and there, as occasion hath serued.
Fyrstle therefore let vs consyder what it hath denne ouer
the Equinoctiall lyne, and vnder both the Poles at one
instant, yet dyuerslye and contraryly the one to the other.
For so hath the infinite wisedome of the greate God
of nature, the supreame Architecture of the vniuersall
worlde, disposed all thynges in suche perfecte order, that
to them that are vnder the Equinoctiall, and haue theyz
Horizon passing by the two Poles, the daye is of .xxi.
houres, and the nyght as muche, and theyz yeere also
is diuided into .xi. monethes: But they that dwelle in
and perpendicularly vnder our Pole, and that haue theyz
Horizon passing ouer the sayde lyne, haue the daye of
syre monethes: That is to say, begynnyng from the
tenth daye of Marche, when the Sunne commeth ouer
the sayde Horizon, vntyll it returne to passe vnder the
same at the tenth of September. And contrarywyse, one
night of syre monethes haue the inhabitauntes vnder the
Pole Antartyke: whose yeere, (that is to saye, all the
course that the Sunne maketh by the .xi. signes of the
Zodiac) is accomplayshed in one day and one nyght. A
thyng doubtlesse moste woondershull and marueylous.
Lykewyse, when we haue Sommer, they that are vnder
our Pole, haue the day of syre monethes, and they of
the opposite or contrarype Pole, haue theyz nyght of the
same length. Agayne, when it is wnter with vs, then
vnder our Pole is the nyght of the sayde syre monethes:
and vnder the opposite Pole, is the day of the same length.
So that, as it were, course by course, when we haue the
nyght, they haue the day: And contrarywyse, when we
haue the day, they haue the nyght. The which, although
it be so long, and of so greate space of tyme, yet is it not
continually obscured with darkenesse. For the Sunne
maketh his course in suche order, that the inhabitauntes
of that parte, lyue not duryng that tyme altogether in
darkenesse, as Poles lyue vnder the grounde, but as
other creatures that lyue vpon the globe and sage of the
earth,

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earth, they haue suche lyght as may suffice to susteyne
and maynteyne theyr lyfe. For the bodey of the Sunne
declyneth no more eyther beneath the Equinoctiall lyne,
eyther above the same lyne (which is the Horizon to both
the Poles) then 23. degrees: that is to saye, no lower
or h[igh]er then the Tropikes, whiche are no more then
23. degrees, or there about, from the sayde Equinoctiall
that is theyr Horizon, as is also sayde. And yet in these
23. degrees, he maketh not his course by the opposite Di-
ameter, but goeth continually rounde about in circuite:
so that his beames reverberatyng heauen, represente
suche a manner of light, as we haue in Sommer, two
houres before the Sunne ryseth. And this example whiche
we haue taken of the diversitie of the Horizons of the
Equinoctial, and vnder the two Poles, is to demon-
strate the marueilous effecte that the Sunne maketh,
departyng from the xiij. houres of the Equinoctiall (that
is to saye, from Aries, to Libra) and commynge by lyttle
and lyttle, illuminatyng the Globe of the earth, and so
reduyng the yeare of xiij. monethes, into one onely day,
and one nyght, as is sayde before. Under the infinite
varietie of the whiche course, sometyme with long dayes,
and sometyme with shorte, all the Inhabitantes of the
worlde are fourmed and disposed, of suche complecion
and strength of bodye, that euerie of them are proporcio-
nate to the Climate assigned vnto them, be it hotte or
colde, and may dwel and abyde there, as in theyr natural
place, and temperament, not lamentyng, or desyryng to
dwel elsewher, so grete a loue realesteth in them to theyr
native situation. But not to departe from the byage
whiche the Sunne maketh in one whole yeare, as some-
tyme approchynge neare vnto vs, and sometyme depar-
tyng from vs, I saye, that at one selfe same tyme, in dy-
vers partes vpon the rounde Globe of the earth, it can-
seth the Sp[ring]yng, Sommer, Autumne, and Wynter.
And neuerthelesse, at the same instant and punct of tyme,
it maketh day and h[igh] noone in one place, and night and
mydnyght on the opposite parte. The whiche varietie, al-
though

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Though it appears incomprehensible to the blindernesse of our wittes, yet beholding the same with the eyes of understanding, and therewith considerynge the vnestimable mouing that the Sunne maketh continually, we shal finde it to be true, hauing respect to the diuers situations of the earth, as it is continually illuminate more or leesse by the Sunne. And this varietie is made with such a Harmonie and consonancie, and such a lawe perpetuall and immu-table, that if any poynt or prike therof shoulde fayle, it is to be doubted least the elementes shoulde be confounded togeather, and returne to their syrte Chaos.

And to haue sayd thus much of the wonderfull effectes of the course of the Sunne, it may suffice for an example to prove how necessary a thing it is, not only for all Pilotes & Sea men to haue the knowledge hereof, but also for all other such as shal attempt great & farre voyages in unkno-wen landes and straunge countreys, as dyd of late Master Jenkynson, a worthy gentleman, set forth by you, & mainteyned at your charges, moxe lyke an Ambassador sent from any Prince or Emperour, then from a compayne of merchant men. Wherein, what commendation you haue deserued, to the encrease of your perpetual fame & honour, I reserue it to that I haue sayde before. And as touchyng master Jenkynson, what travayles, paines, & dangers he hath susteyned, & hardely escaped, and what diligence and arte he hath vsed in the searchyng of straunge countreys, and in the description of those his voyages, it were but in bayne for me to wyte muche vnto you, vnto whom the same is better knownen then to me. And therefore to conclude, with rendyng just commendations both vnto you & him, I can say no more, but as Plato writeth in his booke De Legibus, Decens est eos ciues laudibus ornare, qui corporis vel animi viribus, res arduas preclarasque gesserunt, & legibus libenter paruerunt. That is to say: It is decent to commend those Citizens, that by theyr industrie of bodye or mynde, haue donne great assayres, and haue willingly obeyed good lawes.

And

The Preface.

And thus eststones desyryng your Honours and Wooy
hyppes, to accept in good parte whatsoeuer I haue sayd
of good wyll and affection towarde you and your p^{re}
cedynges, and with your sheilde of Justice and
auctoritie, to defende me agaynst the assaultes
of suche as are enemies to vertue, and
capitious of other mens doynges:

I rest at your commaunde,

ment to the bitemoste

of my power, to do

you what seruice

I maye.

(. . .)

The Epistle Dedicatore of Martin

Cortes, to the most mightie and victorious
Monarch Charles the Empour, the syt
of that name, Ryng
of Spaine.



¶ Greatly were esteemed the inventours of certayne artes and sciences in
ancient tyme (as wryteth **H**aind **A**gustin in his booke **D**e **c**ivitate **D**e*o*)
that they tooke them not for mortall
men, but honoured them as immortal
Gods. **I**hsus arryng in Egypt, ordel- **I**hs.

The first in-
ventours of
artes.

ned common weales with iuste gouernaunce, gave them
lawes, and knowledge of letters, and taught them also
the use of Flare. In consideracion whereof, she was
honoured of such as then knew her, and reverenced of
them that came after her: In so muche, that they estab-
lished a capitall penaltie or punyshment of death, against
all such as syfher in spoote or in earnest affyrméd her to
be an earthly woman, and not rather a divine Goddess.
Ceres beyng of lyuely witt and cleare understandyng, **C**eres.
beholdyng in the Cicilians humane similitude, and
shape to the outwards apparence, and inwardly the **T**he **Cicili-
ans**,
sincerenesse of bruite beastes: brydeled theyz customes,
and resourmed them with new statutes, teachyng them
to tame Oren to beare the yare, to soiwe Wheate for
theyz great commoditie, to Frynde in the Wyll, to
kneade in the house, and to bake in the Ouen. In re-
compence whereof, they made sacrifice vnto her, and
brydeled many sumptuous temples in honour of her. Sa-
turnus coming from **C**ret, gaue lawes vnto the **Latines**, **S**aturne
whereby they myght gouerne them selues, and prescribed **G**aue lawes to
them maners of living, teachyng them to Wyll and Ma- **the** **Latines**,
nure the grounde, and soiwe Corne, and to geather ryte the grounde.
frutes in due season. And yf Saturne were profitable
to those nations, and they not unthankfull vnto hym,
in that they brydeled hym Aulters, celebrated vnto hym
festiuall dayes, and accounted hym in the number of

The Epistle.

**The golden
world & raign
of Saturne.**

**The worthy
saintes of
Charles the
first.**
Sicilia;

**Spayne re-
formed.**

**The trium-
phes and vic-
tories of
Charles the
first.**

the heavenly Goddes, naming hym also the father of the Goddes. And if (I say) he was to them so profitable, and that world judged so happy and prosperous for having so valiant a kyng, & so just a law gener, that it was therfore by the mouthes of all men called the golden worlde, and raigne of Saturne: Certes, except I greatly deceave my selfe, this our tyme is nothyng inferior to that. For we know certaynly that your Maiestie hath ben more profitable to Spaine, then ever was Saturn to the Latines: and also a moe excellenter law gener, in maner to al Europe, and further, to the newe world lately discouered, then he that gaue lawes but only to a little corner of Italy. Wherby I consider, that y felicitie of your Maiesties tyme, hath ben no lyttle commendation to your doinges, in that you haue banyshed vice, honoured vertue, punished offenders, and sauoured innocentes: so that the quiet hane therby lyued more peaceably, the vnquiet restrayned, the good exalted, and the euyl chastised: In so much that now, by reason of just ministracion of good order in your Maiesties dominions, they that walke in the nyght go in safetie, wheras we know, that in other provinces, such as walke in the day go in daunger & peryl. And therfore in the most happy tyme of your Maiestie, it appeareth that Spaine is renelwed, not onlye in the excellencie of mechanicall or handy craftes, but also in the knowledge of letters and discipline of warre: In so muche, that she that somtyme lacked her selfe, may nowe abouindantly minister to her neyghbours that hane needs. And whereas to your Imperiall Maiestie, it shoulde not suffice to ordeyne lawes, yf power and armes shoulde fayle to defende and punishe: who, comparable to your Maiestie, enjoyeth the one, and wanteth not the other, hauyng triumphed ouer kynges and kyngdomes, enlargyng also the name of Spayne in many unknownen and barbarous landes and nations: Greater duetie therefore owe your subiectes unto you, then ever dyd the Egyptians to Isis, or the Cicilians to Ceres, or the Latines to Saturne, soasmuch as they haue receaved of your Maiestie moe common and profitable benefites. It is not long since your Maiestie hath so bidden

bydden and abolyshed the use of Mules, and restored as Mules, gayne the exercycle of armes, so long out of use, that the one with the other, hath ben no smale profits and commoditie to your subiects and dominions. For by takyng horses and always the use of Mules, is so increased the number of horsemen, horses and horsemen, that such as before neyther durst nor could in maner light vp vpon a horse, can no wise easly & aptly manege them. So that you seeme to haue ruined the dayes of Bellerophon the sonne of kyng Glaucus, and **Bellerophon**, lykewylse the tyme of **Saturne**, when men had firsste the knowledge howe to make horses to abyde the byrdle, and to bring them vp to serue for dyuers uses and necessyties of men. And ryght sure I am, that by reason of such laudable statutes and ordinances in your dominions, shall sayle neyther horses, nor horsemen, as well for the courte, as for the campe. Who kniȝt in manner howe to Wearyng of g̃yrd a swerd, before that your maiestie permitted weapons and armure to be borne, ouen in your courte, and that els where, al men myght do the lyke: before which tyme hereticis sayled, where courage abounded. Duer and **Fraunces** the besyde the profite and commoditie that hath rySEN hereto, **French kyng** taken prisoner what honour you haue obteyned by the same, is manifest by **Fraunces** the scenche kyng, who by your Maiestie being taken prysoner in the parke of Pavia, was brought to Madrid, in the yere. 1525. wher seryng many young men in manner without beardes, and yet laden with armour and weapons, sayde: O happy Spayne, that bryngest soorth and nouelshes of menne of warre. In your mooste happy dayes also, the Christian sayth is amplified, an sayth en larged. The sumptuous buildings and ryches of Spayne. The Indies naues of gold and silver. The Christian sayth is abundantly enriched in treasure brought from your Indies, farre surmounting the riches of **Salomon**, brought from **Ophir**. Pea & to say the trueth, considering the Paules of gold & siluer, which haue benne ordinarily brought from thence to your māle. **Neue landes** and **Ilades** discovered, heretofore so vnknownen to the Cosmographers, Geogra-
phers,

The Epistle.

Peru.
The straigh-
tes of Maga-
lianess.

Rio de la
plata.
The fortunate
Ilandes, or
Canaries.

Religion in
the Indies.

The Spany-
ardes haue
ever traunaled
into farre coun-
tryes.

The antiqui-
tie of Nau-
igation.
Argonanti.
Colchos.

The arte of
Nauigation.
Thinges par-
taining to
Nauigation.

phers, & Historiographers, that they never heard of theyz names. Whiche neverthelesse are nowe so well knownen to your subiectes, that they haue troden them with their feete, and measured them by pases. Who before this time ever hearde anye mention of the riche and large Province of Peru, or of the straighthes of Magalianes, or of the ryuer of Syluer, called Rio de la Plata. They in tyme past seemed to haue donne no smale thyng, when they had knowledge of the fortunate Ilandes, the whiche, since they were con- quered by your Maesties graundfather, haue benne called the Ilandes of Canaria. And yf it be, and hath benne much to discouer and subdue this newe woorlde: it is doubtlesse no lesse glorie to your Maestie, not onely to possesse and enioye it, but also that you daylye procure to sende thither Judges to gouerne with lawes, and preachers to instructe in doctrine, to bryng those Indians to the knowledge and honouryng of the true God. And therefore consideryng your Maesties godlye desyre and purpose, as touchyng these Nauigations, and the daungers of suche as goe to discouer this newe woorlde (albough it be not new to the Spanyardes to trauayle into farre countreyes, soz as muche as in the dayes of Caius Cesar, the sonne of Augustus, were founde broken peeces of Spanyshe shippes, losse in the goulfe of Arabie, as also, Celsus Antipater affirmeth, that certayne shippes of Spayne were accustomed to sayle soz Marchaundise to the East partes of Ethiopia) in considera- tion hereof, haue I the more wyllyngly published these my trauayles, for the furtheraunce of all suche as shall hereafter attempte the lyke Nauigations. And here doo I not saye that Nauigation is not a thyng of antiquitie. For we reade that in olde tyme the Argonanti sayled to Colchos, and Danaus brought the firsle shippes from Egypce to Greece. But I saye, that I am the fynde that haue brought the arte of Nauigation into a brefe com- pendiousnesse, geuyng infappleable principles, and evident demonstrations, describynge the practise and spredulacion of the same, geuyng also true rules to Maryners, and shewyng wayes to Pilotes, by teachyng them the ma- kyng and use of instrumentes, to knowe and take the al- titude

titude of the Sunne, to knowe the tydes or ebbynge and flowing of the sea, howe to order their cardes and compasses for Navigations, geuyng them instructions of the course of the Sunne, and motions of the Moone: teaching them furthermore the makyng of Dyalles, both for the day and for the nyght, so certayne, that in al places they shall shewe the true houres without deceipte: and haue stone, fassifyed ^{The lode} ^{called in Eng.} ^{lykewise declared the secrete propertie of the lode stone, like Adamar,} with the maner and causes of the Northeastynge & North-Westynge (commonly called the varsalion of the compasse) ^{is in Latin} ^{called} with also instrumentes thereunto belongyng. And that, ^{Magnes.}

that whiche I shall saye or do, be not accempted to be presumpteouslye done or spoken, I acknowledge that whatsoever I haue well done or witten, it is from a boone by the helpe of the divine grace, and by the fauour and prosperous fortune of your Majestie. And thus shall they that nowe lyue, and lykewyse they that shall succeeds vs, see and perceave, howe much moare the woldē owesth and is beholdinge to your Majestie, then were the auncient Egyprians to their Isis. She gaue them letters to ^{Charles the} ^{first greater} ^{than the Ho-} ^{toes of olde} ^{tyme.} reade, but your Majestie hath gauen rules and orders to discouer on these seas. The profite of Isis, was onlye for one province. But the commoditee that ensueth of your do- ^{Universall bo-} ^{nelytes.} ynges, is vnuersall for all provinces and nations, and for all seas, as well to go to places discovered, as also to discouer landes and regions yet unknowen. If they of ^{Comparyon} ^{with the an-} ^{ciques,} Auncient tyme had reached that we haue obteyned, the Indies had not nowe bene to discouer: neyther shoulde it be esteemed a myracle vnto vs, as at the tyme when Carthage flourished, that one Agnus went soorth from the Plinie baye of Cadiz, and sayled to thende of Arabie. Neyther Navigations woulde Cornelius Nepos haue witten it for so famous a of olde tyme. thynge, that a certayne man flying from Byng Latinus, came from the goulfe of Arabie: Wherby it is manifest, that as well Nauigation, as other artes, both from dayes to dayes increase, and by lytle and lytle is come to perfection. For wth those dayes they had neyther compasse nor cardes of saylyng whereby to gouerne them selues. They lacked the consyderation of the staires, vntyll the Phen-

The Epistle.

The rudenesse
of the anti-
ques.

tians founde the knowledge thereof, and were the syssies
that vnderstoode (that to suche as shoulde trauayle by sea)

it shouide be necessarye to lyft by theyz eyes to heauen,
and consider the motions therof. They that sayled to
the Ilande of Taprobana (which in olde tyme was called
Antitono) caryed for their vyages lyuyng byzdes. And

Augurium. When they thought good, let certayne of them see: and
by the syght of their wynges, directed the helme and
sayles of theyz shypes. They sayled onylle three monethes in the yeere. To them therefore it was necessary
to obserue and sarye the tyme, vntyll they founde it to
serue with a forewynde. They knewe not howe to helpe
them selues with the bole line, or syde wynde: neyther
sawe they the North Starre, or sought it, or hadde any
knowledge thereof. And I beleue verly that this was
the cause of so long a vyage whiche the shypes of Salo-
mon made, saylyng to Tharsis and Ophir, wherein they
spent three yeeres: although in deede that was no shor^t
vyage which they made, compassyng about India, and
many other provinces. And whereas before I sayd, that

Pauigation by lyttle and lyttle came to perfection, I
synde by auncient hystories, that Ipho syssit founde the
Gouernal, or Rudder, Dedalus the Haile and Shrowdes,
and Icarus the Sayles, the Thirreni founde the vse of
the Anker of one grapse or stooke, & Palaminus brought
it to perfection, addyng the other. And thus may it ma-
nifestly appeare, that in these prosperous and fortunate
dayes of your Maiestie, it hath pleased God to bryng the

Commodities
and difficult-
ties of Pau-
igation.

knowledge of Pauigation to perfection, with this my
breke discourse as touchyng the same, aswell profitable
and necessary for them that trauayle by lande, as by sea.
What can be a better or more charitable deede, then to
bryng them into the waye, that wander? What can be
more difficult, then to guyde a shyppe engoufled, where
only water and heauen may be scene. One of the fours
most difficult thynge, wherof Salomon maketh men-
tion in his Proverbes, is the vyage of a shyppe by the sea.
The which Galfred expondyng, sayth, that in humaⁿ
thynges, none is more fearefull or more daungerous,

then

then to aduenture life in a weake and thinne peece of wood,
or for a man to commit him selfe to the rage of furious win-
des, among the tempestes of the sea, and there to hasarde
that he loueth so well. O how muche more should the same
seeme difficult to Halomou, ys at these dayes he shoulde
see that fewe or none of the Pilotes can scarcely reade, and
are scarcely of capacitie to learne. And whereas in the firste
Chapter of this booke, I haue made mention, that the go-
vernall or sterge, ought to be committed to expert menne,
and of good vnderstanding, he shoulde see, that nowe a
dayes, the ignorant presume to governe other, which were
never able to rule or governe them selues. I moche humblye
desyre your maestie, to receave in good part this my poore
seruice: whiche, although it be little, yet being dedicate vnto
the greatnessse of your Regall person, it shalbe muche
more then greate. The profite and commodtie therof, is no-
torious, and the benefite that thereby maye be receaved, is
uniuersall. If therfore, when your maestie shall finde your
selfe released from greater assayres, it maye please you
to feede your eyes with these my trauayles, you shall
 finde therein many newe, delectable, and witty thin-
ges, with also many profitable and certayne rules,

both to reade and vnderstands. To con-
clude, I ellsoules make humble pe-
titions to your Imperial Ma-
iestie, not so muche to
consyder what I
wyte,

as to respecte the intent of my wytyng: and
not the gyfte, but the affection and
good wyll that remayneth
in me to serue your
Maestie.

The igno-
rance of Pil-
otes.

The govern-
ment.

The first parte of this woorke, whiche
entreateth of the composition of the
worde, and of the vniuersall
principles for the art of Pa-
uligation.

The firſte Chapter, of the general diſtincſion
of creatures.



Three diſſe-
rences of crea-
tures.

Corporal crea-
tures.

Man is called
all creatures,
and the leſſe
worlde.

Man compa-
red to the
worlde.

All that mo-
ueth, is mo-
ued by an o-
ther immo-
uble.

The intellec-
tive ſoule.

HE infinite God, the beginnyng and cause of the whole vniuersal, created three orders of creatures, differing in kynde: that is to ſay, corporall, as the Clementes: ſpirituall, as angelles: and compounded of theſe two, as man. The corporall nature, is diuided into bright and ſhyngng bodyes, as the ſtarres: or into darke and thicke bodyes, as earth and metals: ryther into Diaphane or transparent bodyes, as ayre and water. Of theſe creatures (as ſayth. S. Gregorius) ſome haue onely being, as ſtones, ſome lyue, as trees, & other haue ſeſe, as beaſtis, other, vnderſtandyng, as man: who in hollye scripture is called all creatures, accordingyng to the ſaying of Chrift to his diſciples, where he ſayth, Go and preache the Goffell to all creatures. And therefore not without good cauſe was man called of the Greke philofophers, Microcosmos, (that is) the leſſe worlde. In the which we contemplaſte thyngeſ of no leſſe admiration, then in the great worlde. The ſimilitude betwene them both, is, that euē as the great worlde, & the whole globe or ſphere thereof, is mooued by the voluntarie motion of an inſelectiue ſubſtance, or an angell: euē ſo is this. For (as Aristotle wryſteth) what ſo ever is mooued, is mooued by vertue of an other: as man is mooued by the internal or inwarde ſoule, that is within him, (that is to ſay) by the inſelectiue ſoule, that is proper unto hym. In lyke manner, in the greate worlde are founde dyuers moouable thyngeſ: All whiche are reduced to one immoouable moouer. So in man are founde many thyngeſ mooued by diuers motions, whiche are

are all referred to his intellective soule. The great worlde Man knoweth
part of al this conteyneth the creatures within it selfe, and consequently ges. is all really, as hauing nothing without it. Euen so, man by knowledge is all, and knoweth al thynges, and nothing naturally is hid from hym, or unknownen to hym. Againe, in this lesse humane worlde, are two motions, intellective, Two mot- and sensuall. Then consequently the great worlde hath as in man. two local motions. The one, wherwith the first mouable Primum is moued, and dwelveth with it al the other spheres, from mobile, the East to the West, and is called Rationall mouyng. Rational mo-
tion. The second, is the mouyng of the other spheres, from the Irrational West into the East: and is called Irrational mouyng. Irrational motion. But nowe leauing to speake of the lesse worlde, we wil pro- ceede to speake further of the greater.

¶ The seconde Chapter, of the defini-
tion of the worlde.



THE worlde (as sayth Isidorus) What is the
worlde. is heaven and earth, and the o-
ther woorkes of God, that are
conteyned therin. It is compoun-
ded of thynges visible, and yet
unsearchable. That is, clea-
nyng or beautifull, and so named it, because of the marney,
nesse, or fayre-
nesse. Philosophaers called it Mundus Or Mundus
a mouendo, because it is in continuall mouyng, and never a Mundi-
tia, in rest. The Grekes called it Cosmos, whiche signifieth, Eyes were
geuen to men
to behold the
fayreness, and
beautie of the
worlde. That is, clea-
nyng or beautifull, and so named it, because of the marney,
nesse, or fayre-
nesse. Or the
roundnesse of the
worlde. Greke tongue, signifieth a rounde body.

The first parte.

¶ The thirde Chapter, of the definition of the Sphere.

Definition of
the Sphere.

The center of
th. Sphere.

The Aris and
Poles of the
worlde.

Quinta es-
sencia,
Bristotle cal-
leth it the. v.
Element.



Herodotus sayth, that the Sphere is a whole and corporall figure, vnder one superficiale: in the mydest whereof, is a poynt or priche, from the whiche all ryght lynes drawen directlye to the circumfrence, are equal.

This poynt or priche, is called the center of the Sphere. Accor-
dynge to Euclides, it is the passage of the circumference of
halfe a circle, whiche is turned rounde about his Diameter
that is fixed, vntyll it returne to his owne proper place
agayne, as where it was at the firsle. By the center of the
Sphere, passeth a ryght lyne, and thereremaynes or endes
thereof, touche in the circumference. And this lyne (magis-
ned) is called the Aris, or Creltree of the Sphere, & the endes
thereof are called the Poles. Upon this Aris, is the Sphere
of the worlde moued.

¶ The fourth Chapter, of the diuision of the worlde.



It is to be presupposed, that there
is difference betweene element, &
elementate, & the fift, being cal-
led Quinta Essentia. The quint
essence, or fift substance, is a bo-
dy of it selfe, differing from al ele-
mentes, and thynges elementall,
as wel in matter, as in forme, and
no lesse in nature and vertue: and

hauyng in it selfe no contrarietie, is certainlye without cor-
ruption. And hercōf commeth it, that the Philosophers cal-
led the heauens and heavenly bodyes, the fift substance,
or fift essence, by reason of the incorruptibilitie thereof.
Element is that, wherof any thyng is compounded. It is
the firsle of compositions: and of it selfe is not compounded.
Wheraby it soloweth, that neyther the earth, the ayre, the
water,

The. v. es-
sence is incor-
ruptible.
what is Ele-
ment.

The inferior
Elementes
are not pure
nor simple.

The first part.

water, nor the syre, that are neare unto vs, or about vs, are pure or simple elementes. For these elementes doo sometymes myngle them selues one with another, and especially where they are neare togeather, and touche one an other. Of these elementes every part is named by the name of the whole: As every part of syre, is called syre, and every part of earth, is called earth, and so of the other.

They are called simple bodyes, in respecte of other compounde and mixt bodyes. They are diuisible into partes of dyuers fourmes: and of the commixtion of them, are made and engendred dyuers thynges of sundry kyndes.

These four (that is to meane, earth, ayre, water, and syre) although they are named simple, but in respecte as aforesayde, yet are they the elementes (that is to say) beginnynge and principles of al other compoundes & mixtes.

A pure element can not be seene, soasmuch as that that is pure, lacketh colour: & that that hath no colour, is not visible. The elementes (as sayth Isodorus) were diuided by the hand of God. The Imperial heauen was replenished with Angels, the ayre with byrdes, the sea with fyshes, and the land with men, and other beastes. Clementate, is every body compounded of the four elementes. Not that they are elementes formalye, but vertually in mixt bodyes.

This knownen, we wyll shew we holde the worlde is diuided into two regions: Celestiall, and Elementall. The region Elementall, which is continually subiect to alterations, is diuided into four elementes: which are, earth, water, ayre, and syre. These elementes, the Greeks call *Yctogia*, for the communion and concorde that they haue betwene them selues. The heavenly or ethereal region (called *Quinta Essentia*) compasseth and conteyneth the elementall worlde

within it.

The elementes are diuisible into partes.

The commixtion of elementes.

Pure and simple elementes can not be seene.

The diuisiōn of elementes, what is Clementate.

Division of the worlde into Celestiall, and Elementall.

Quinta Essentia.

* The .v. Chapter, of the number, order, and propertie of the Elementes and Heauens.

The

The first part.

The order of
Elementes.

Earth.

Water.

Ayre.

Fyre.

The sourme
of the water.



He earth (after the philosopher) is a
prickle or poynit in the myddest, called
the center, to the whiche they assigne
the lowest plac. Next unto the earth,
and about it, the water occupieth the
seconde place, and the ayre the third.
The fyre is hygher then any of the o-
ther elementes. And it is to vnder-
stand, that the water hath two superficiale.

One, which
is called concave or hollowe. The other, conuer or em-
bowyng. You maye compare the inwarde parte of the
concave to a dyshe or a bolle, whose outwarde parte is
called conuer. As touchyng the concave, the water com-
passeth about the earth, leauyng discovered that parte
that serueth for the respiration and lyfe of men, and o-
ther beastes. As concerning whiche, somme thyngie that
the Ocean sea is hygher then the earth: and aske the
question why the sea couereth not the whole earth, and
why the earth is not sonke in the water. To this it may
be a sufficient aunswere, that it hath so pleased the wyll
of God, accyding to the saying of the Prophete David:
Terminū posuiti quem non transgreditur: Neque cons-
vertetur operire terram. That is: Thou hast appoynted
limistes, which it shal not passe, neyther shall it returns
to couer the earth. Besyde, the wyll of GOD, whiche is
the cheife and sufficente cause thereof, we say that natura
sayleth not in her necessaries. For the sometyme ad-
mitteth a little inconueniente, to auoyde a greater evyl:
as when heauy thynges, which naturally shoulde descend,
do not onlye not descend, but rysse vp: And as also some-
tyme it chaunceth that fyre descendeth, and water arry-
seth to fyll the boyde or emptie place, leasse anye whers
should be founde boyde oremptie, whiche nature so great-
ly abhorreth. To this purpose, nature foreseeyng the
kyndes of many thynges that coulde not els wheres lyue
then on the earth, neyther be conserued within the wa-
ter(as men, and other earthly beastes) determined be-
fore to make the earth not perfectly reunde, contrarye to
the nature therof: wherof it foloweth, that it is not al-
together

psal. cvii.
Job. xxxviii.
The wyll of
God, is the
cause of causes

Mature ab-
horreth emp-
tines.

The earth is
not perfectly
rounde.

together covered of the water. And as (sayth Drigen) the earth remayneth discovered of water, that it myght bryng Division of the ayre into three regions. sooth frutes, trees, and plantes. As touchyng the conuer the ayre into three regions. aforesayde, the water and earth discovered, are conteyned under the concavitie of the ayre, whiche is diuided into three Regions, as the lowest, hyghest, and myddlemoste. The lowest is hot, by reason of the refelction or rebounding of the beames of the Sunne, strycken backe by the earth. The hyghest also is hot, by participation of the ayre, and nearenesse thereunto. The myddle region is colde, as is manifest by the snowe and hayle, engendered in the same. The ayre neare vnto the Region of the ayre, whiche is pure heate, dooth neyther burne nor lyghten, because it hath no combustible matter, and so hath it power, and not acte. It is neare vnto, and reacheth the circle of the Moone, whiche compasseth it about. The heauen, or circle of the Moone, is next vnto the heauen of Mercurie: And Mercurie vnto the heauen of Venus: Venus vnto the Sunne: The Sunne, to Mars: Mars to Jupiter: Jupiter to Saturne, whiche is next, and reacheth vnto the heauen of the Starres, called the firmament, because that in it are all the starres (excepte the planetes) firme and fift as a knotte in a table. The knowledge of the planets was had by seuen sundrye motions they have among them selues, and by theyr course, not vniiforme to that of the starres of the eyght heauen, because that sometimes the planetes appeare vnto vs ioyned togeather, and sometimes diuided. The Cristalline heauen compasseth line heauen. about, or conteyneth within it, the heauen of starres. This Cristalline heauen, is transparent, & perspicuous, as cleare water or glasse that maye be seene through, by reason of the clearenesse and pure substance thereof. It is by an other name called, the heauen of water, whereof hollye of water. scripture speaketh, saying: Aquæ quæ supra cælos sunt, laudent nomen Domini. That is to say: Let the waters psalm.14.8. that are aboue the heauens, prayse the name of the Lord. It was created for the conseruacion of corporall thynges, and to temper the heate engendered of the mouyng of the firste moueable, whiche being so greate of bodye, that it not onely compasseth all the Clementes, but also all the inser- Daniel.3. The mouing of the firste moueable.

The first part.

The coldenesse
of the Crista-
line heauen.

The heauen
of the fyre
inuocable.

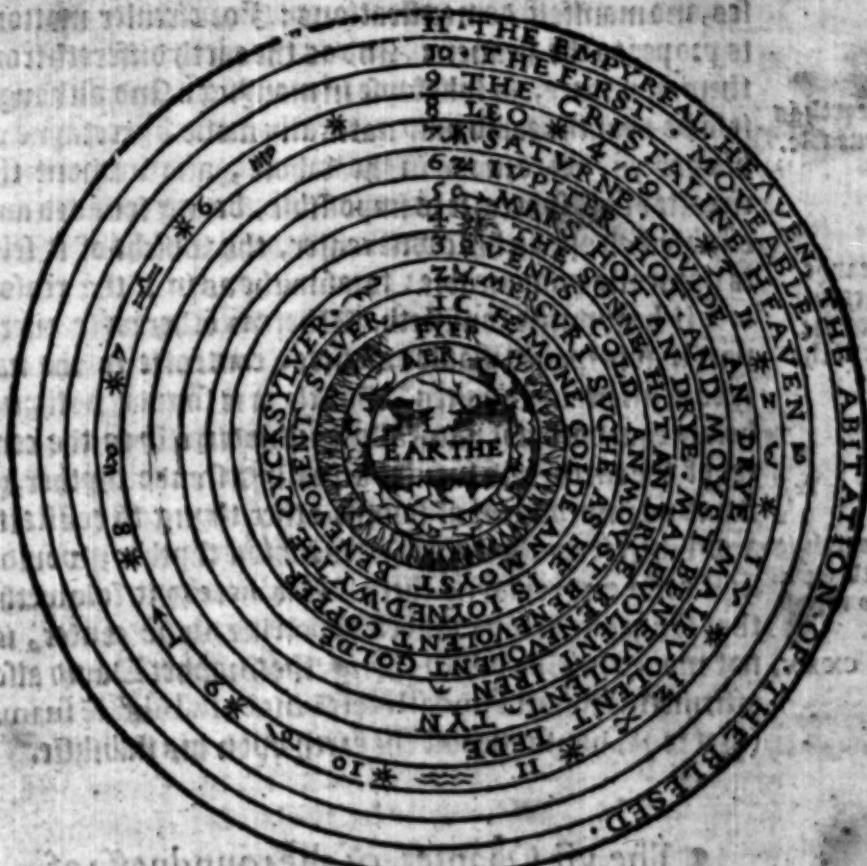
The heauen
called Empe-
riuum, is not
mooued, and
is the habita-
tion of angels.

The huma-
nitie of Christ
in the Empe-
rial heauen.

Three orders
of Angelles.

The Emperi-
al heauen, vise-
serueth all the
other heauens.

our heauens is moued so swyftly, that it dayly perfectely mooueth all the aforesayde spheres. And least by reason of the grete heate thereof, caused by his swyft motion, it shoulde consume in seruour thynges, God ordeyned this Cristaline heauen, that the coldenesse therof might temper the extreame heate of the other. This Cristaline heauen, reacheth to the first moueable heauen, called Primum mobile. And this reacheth to the Emperial heauen, which is the twelvth, called Emperium, by reason of his clearenesse and resplendence. This is not mooued, and is most perfect. The Philosophers hadde no knowledge herof. But we beleue by holye Scripture, that liche a heauen there is, and the same to be the habitation of Angels, and spiritual creatures. It is also called Coelum coelorum, that is, The heauen of heauens: because it conteyneth & includeth within it al the other heauens. It is of greater clearnesse then all the other heauens, and was created immediatly with the Angels. In this also remayneth the humantie of Jesus Christ our God, and in dignitie aboue it. It conteyneth three holye orders or principalities, called Hierarchias. Whereof the firste is called supercelestiall, and hath in it also three orders, Seraphins, Cherubins, and Thrones. The seconde is called Celestial, and conteyneth Dominations, Principates, and Potestates. The thirde, called Subcelestial, conteyneth Virtutes, Archangelles, and Angelles. And to conclude, it hath a boundance of al goodnesse & perfect felicitie, with priuation or want of al evyl. This heauen also genereth influence of constancie, stedfastnes, and durabilitie to thynges, against the fluribyltie and inconstancie of the other heauens: the order whereof, dooth appeare in the demonstration so lowyng.



The vi. Chapter, of the immutabilitie
or immobilitie of the earth.



¶ Pithagorians and o-
ther ancient naturall philoso-
phers (as sayth Aristotle) were of opinion
of opinion that the earth dyd that the
move. Yet not by a ryght sooth earth mo-
tion, but circularly about in a Molas in
mydle of one place. The whiche loco.
error, both Aristotle hym selfe, &

The earth is
immouable.

All heauy
thynges en-
cline to the
center of the
earth.

The earth is
and when it toucheth there, or is come to thyther, woulde
be founded vpon his owne
center.

Psal. cxxxv. not moued. The which thyng, the Prophet David also
affirmeth, saying: Fundasti terrā super stabilitatē suam,
(that is.) Thou foundedst the earth vpon his stabilitie.

The vii. Chapter, of the roundnesse of
the earth and water.

The round-
nesse of the
earth.

The rysyng
of the Sunne.

The Eclipse
of the Moone.



Pat the earth is rounde, it ap-
peareth by manfeste euidence.
For yf it were playne or flatte,
the dawnyng of the day or day
spryng, shoulde equally and at
one tyme appeare to them in the
West, as to them in the East.
But we see the contrary, that
it appeareth fyshe to them that
dwel in the East, & afterward to them in the West. This
is proued by the Eclipse of the Moone, which begynnyng
at one instant, they of Jerusalem see it begyn at fourre a
clocke of the night, & we of Andalusia in Spayne, at one a
clocke

clocke of the nyght. It foloweth hereby, that to them it nyghteneth three houres sooner then vnto vs in Spaine: and this is caused by the roundnesse of the earth. It is also aswell knownen to be rounde, from the pole Artyke, to the pole Antartyke: for by the roundnesse thereof, is caused the equalitie and inequalitie of the dayes and nyghtes. The same is lykewyse knownen by the rasyng of the pole aboue our Horizon. And that the superficiall parte

The equalitie
of dayes and
nyghtes.

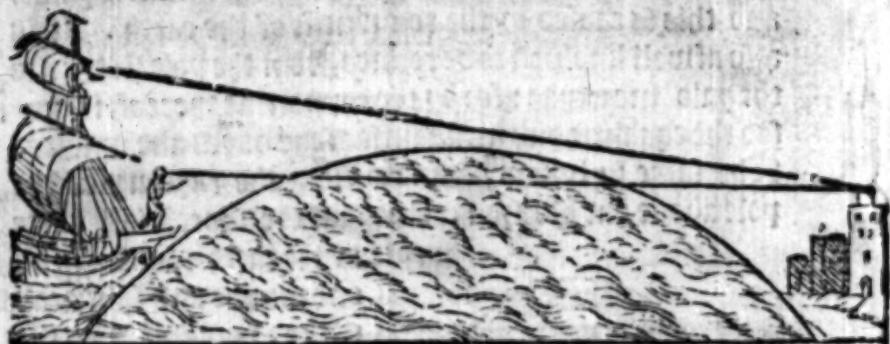
The earth
and the water
of the earth & water, is all are one rounds
one rounde and sphericall globe.

globe, is manifest by the shadowe thereof, beynge a certain darke body, reflected frō the earth in the Eclipse of the Moone. For by this, as by playne demonstratiō, may we know that the earth is round, as may more manifestly appear by this figure. It is The water is also proued, y the water is a rounde body a rounde body, as is seeno by experiance. For yf you erect a marke vpō the sea bankē of a port, & a shippes depart from that porke a certayne space: then stan- ding in y poupe or sterne of the shipp, you shal not see the markes aforesayde. But if you stande in y top of the shipp, then may you see it. Whereas not with- standyng (yf that portion of the bending arke of the earth, dyd not hynder the sight) you shold see it bet- ter being in the poupe, for asimuche as it is nearer to



The first part.

The marke then is the top of the shyppe, as by this demonstration appeareth.



Nowe the
earth is round

But here some may moue a doubt, saying, that on the earth we see many mountaynes, and consequently many great valleys and playnes, with many diversities of sun-drye other deepe and unequall places, by reason whereof, the earth can not truely be called rounde. To this I say, that in two maners, the earth is called and vnderstoode to be rounde. As after one maner, speakeynge precisely, it is called rounde, as a circle or a sphere, whiche we call rounde, because that all ryght lines drawnen from the center thereof to the circumference, are equall. The other roundnesse, is considered without this precisionesse: and is such, as not by all his partes is equally distaunte from his myddest or center, but hath some partes bygher, and somme lower: yet not in such quantitie as maye destroy the roundnesse of the whole. As ys in a bowle there were certayne clystes or hoales, it shoulde not therby leave to be rounde, although not perfectly or precisely rounde. And for this cause sayth Auerrois, that although both the heauenly bodyes and the elementes are of round forme, yet dyffer they in this, that the heauenly spheris haue perfect roundnesse, and the elementes not. As the earth, by reason of his mountaynes and vales, the sea by his encreasyng, and decreasyng, the Ayre also for his nearenesse to the syre, and by his contrarietie, doeth sometyme do, and sometyme suffer, (that is to saye) is sometyme active, and sometyme passiue. So that folowing the one, it sleeth the other, by reason whereof, it also lacketh

The ayre is
active and pas-
sive, and not
perfectly
rounde.

lacketh perfect roundenesse. But the syre, so farre as mythe as The syre is
it is neare to the concave of the Circle of the Moone, rounde.
whiche is sphericall, maye therefore be called sphericall or
rounde.

The. viii. Chapter, of the motion
of the heauens and Cle-
mentes.



How the ayre
is mooved. The Moone. Venus. Mercurie. The Sunne. Mars. The starie
heauen or fir-
mament.

L is not to be forgotten, that all the Clementes are wholly moouable by locall motion, ex- cepte the earth. The water is mooued by the motion of the Moone, or tossed by the windes. is mooued. The syre (as sayth Aristotle) is mooued circularly by the motion of the day, and is drawn of the circles that embrasse it, or compasse it about: as is ma- nyest by the Cometes, or blasyng starres, and other syer exhalations, conteyned and engendred in it: Whiche be-
yng carried with this motion, conclude, that the fire mo-
ueth in lyke manner. And with this motion is the super- out parte of the ayre violently carried about, as the other impreßions therein doo shewe. The inferiour part is mooved by divers motions: (that is to meane) laterally, as by experiance we see when the wyndes blow. The Moone with her heauen or sphere, by her proper motion geueth her turne from the West to the East, in. xxviii. dayes, and seven houres, with. xlv. minutes. Venus, Mercurie, and the Sunne, in a yere: whiche is the space of thre. C. lrb. dayes, with v. houres, and. xlvi. minutes. Mars in two yeeres. Jupiter in v. yeeres. Saturne in. xxx. yeeres. The starie viii. heauen, whiche is the firmamente, or starie heauen, by his owne proper motion is mooued by the. ix. heauen, vpon the begynnyng of Aries and Libra, and vpon these two poynetes accomplishlyeth his revolution in seuen thou- sande yeeres.

The first parte.

The Cristall
heauen.

Fyrst moone-
able.

Howe the fyrst
mooneable
draweth the o-
ther heauen.

This motiō is called Motus trepidationis (that is to say) the trembyng motion, or motion of accessē & recessē. The nyng heauen endeth his motion from the West to the East, in. xlxi. thousand yeeres. And by this motion mooveth the eyght heauen. The tenth heauen, called Primum mobile, is mooved from the East to the West: and in xxiij. hours (whiche is a naturall daye) perfourmeth one revolution, and with the myghtie force and swiftnesse of his motion, carryeth with hym all the other inferiour heauen, and maketh them to gene the same turne in. xxiij. hours, where as neverthelesse they ceasse not in the meane tyme, to keepe the course of theyr owne proper motion. As (for example) ys an Ant or Pismere should goe about the wheele of a Wyl, contrary to the moouyng of the wheele: before the Ant in goyng syll foreward, shoulde come agayne to the poyn̄t from whence she syll departed (whiche is once about, or one turne) the wheele shoulde in that space make many turnes.

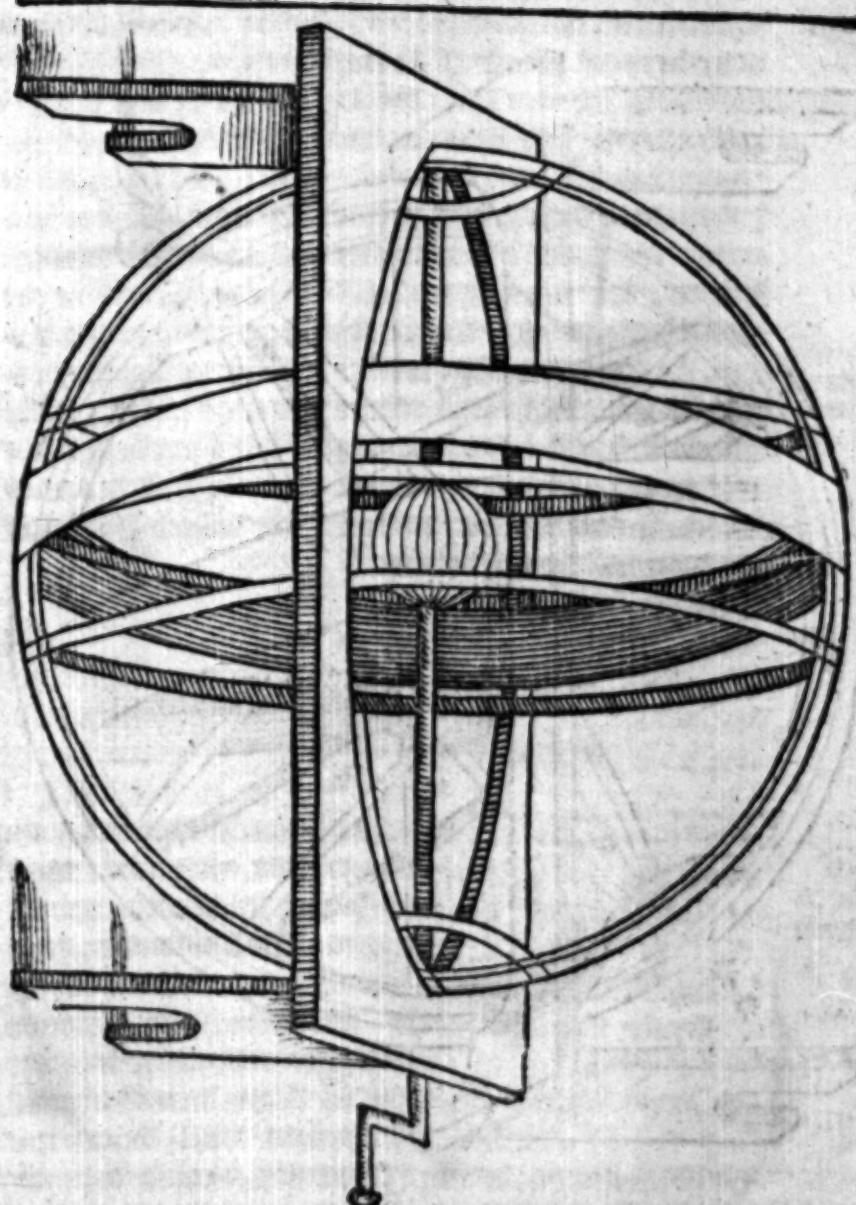
The ix. Chapter, of the diuision of the Sphere into small partes.

The ryght,
and crooked or
oblique Sphere



THE Sphere of the worlde, is di-
vided in two manners, (that
is to say) by substance, and by
accident. By substance, into
2. Spheres, as we haue sayde.
By accident, into a ryght
Sphere, and oblique or crooked
Sphere. They haue the ryght
Sphere that dwelle vnder the
Equinoctiall lyne, and is called ryght, because to them
the Poles are equally in the Horizon, as appeareth by this
figure following.

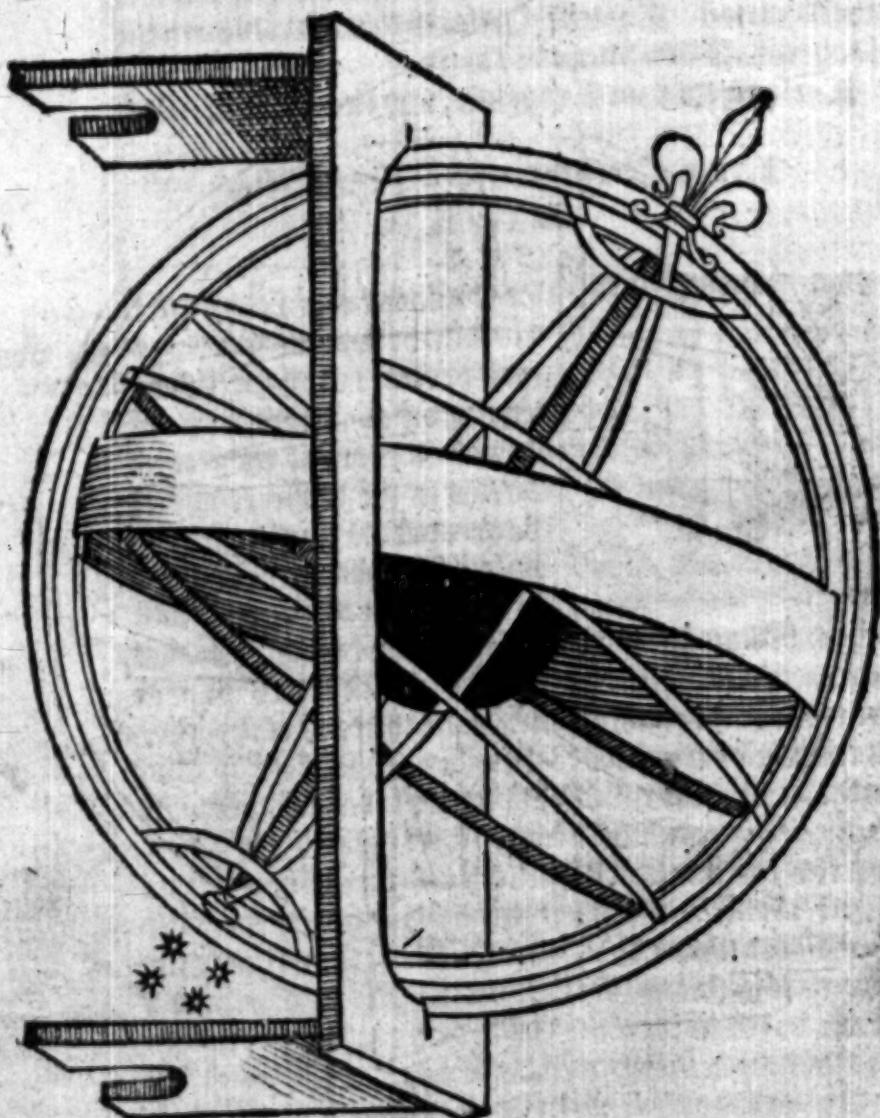
The



They have the oblique Sphere that dwelleth either on this
syde or the other syde of the Equinoctiall; unto whom The oblique
or crooked
B 111. is sphere.

The first parte.

is ever one of the poles above the Horizon, and the other
under it, as appeareth in this figure.



The s. circles The sphere is compounded of s. circles imagined. And (as
of the sphere. sayth John de Sacrobosco in his booke of the sphere) are

of them are greater, and soure lesse. The greater Circle, is that whiche divideth the Sphere into two equall partes, and hath his center with the center of it. These are the Equinoctiall, the Zodiac, the two Coluri, the Horizon, and the Meridian. The lesse Circle, is that that divideth the Sphere into two unequall partes.

These are the two Tropikes, and two Polar Circles.

The x. Chapter, of the Equinoctiall Circle.



The Equinoctiall, is a Circle that divideth the Sphere into two equall partes, & is by every parte noctiall, equally distant from both the Poles. It is one of the greater Circles in the Sphere, and is the greatest Circle of those whiche are described in the Sphere, by the motion of Primum mobile, or first moouable.

This Circle, for his equalitie, and regularitie, is more noble then the Zodiac, which we haue described in the eygth sphere, & also then any of the other. It is imagined to gyarde the world rounde about by East and West. It is called Equinoctiall, because this word

Equinoctium, signifieth equalitie of nyghtes and dayes, whereof the cause is, that the Sunne commynge to this Circle, the Arke of the day is equall with the Arke of the nyght.

and then is the Equinoctiall. It is also called the Zone, or gyrdle of the syste moouable. For even as a gyrdle dooth gyarde a man by the myddell, so dooth this Circle gyarde in the myddell betweene both the Poles, upon the which the first moouable is mooued.

One of these imagined on our parte of the Sphere, is called, Polus Arcticus, because it is neare unto certayne starres, whiche the Astronomers call Arcturus, which is the great Beare. It is called Septentrionall, or Septentrion, because that

rounde about it are mooued the viii. starres, whiche make Tropike, the lesse Beare, commonly called Bozina, (that is, the

The firste
moouable.

The first parte.

The borne.
North starre.

Pole Antar-
tyke.

The crosse
neare unto the
Pole. Antar-
tyke.

home. The starre which is in the cayle of the lesser Beare, is called the North starre, because it is nearest unto the North Pole: the whiche Pole is a certayne poynt in the firmamente, whiche can not be seene, although the nyght be never so cleare. This starre (as the Poet Homer sayth) dooth moue lytle or nothing, because of his little distance from the Pole. The other Pole is imagined on the other contrary parte, and is called Polus Antarticus, of the woord Ante, whiche signifieth agaynst, contrary, or opposite: because it is on the contrary parte from the Pole Artyke. It is also called the South Pole, because that from that part of heauen commeth the wynde, commonly called the South, and is lykewyse called Meridional, because it is ryght South from vs. This is never seene to vs. They that dwelv vnder the Equinoctial, or come nearer unto this Pole Antartyke, haue for a signe or marke to knowe it, foure starres, in fourme of a crosse. And when the greatest of these is lowest in the foote of the crosse, they say it is xxx degrees aboue the pole. And as we can not see theyre Pole from hence, so they can not see our Pole from thence.

The xi. Chapter, of the Zodiacke Circle.

Zodiack.



THE Zodiacke is defined to decline or bende it selfe from the Equinoctial. It is a great Circle, whiche diuideth the Sphere in two equal partes, cutting the Equinoctial by oblique or crooked angles: so that being thus cut, or diuided by it into two equal partes, one part therof de- clyneth toward the South, & the other toward the North. This Circle is called the Zodiacke, of this woord Zon, whiche in the Greke tongue signifieth lise, because that according to the moouing of the planets vnder it, is the lise of

of inferiour creatures: Ω is so named of Zodion, whiche signifieth a lyuyng beast. And is therefore diuided into The twelve xii. equall partes, whereof euerye parte is called a signe, signes of the and every signe hath an especiall name of some beaste, in Zodiack, respect of some propertie agreeable to the same: or for the order and dispositions of the firte starres in those partes, somewhat representing the similitudes of such beastes, it is called Zodiack. The Latins called this Circle, Signifer (that is) the signe bearer, because it carreyth these signes Hewe the sunne is cause of generation & corruption. Ω images in it: also, because the twelve partes, into the whiche this Circle is diuided, are called the xii. signes. Division of the xii. signes. That parte which declineth to the North, conteyneth. vi. signes septentrionall, and the other that declineth to the South, conteyneth other. vi. called Meridionall. Furthermore, it is to consider, that the Zodiack may be diuided in two manners. One, by longitude or length into the xii. signes aforesayde, and every signe is diuided into. xxx. degrees, whiche make. CCC. degrees. Lykewyse, euerye degree is diuided into. lx. minutes, and every minute into lx. secundes, and euerye secunde into. lx. terces, and so to tenn. Division of the Zodiack by latitude. The other diuision of the Zodiack is, by latitude or breadth. By latitude it is diuided into. xii. degrees, and in it we imagine a lyne that diuideth his latitude by the The Ecliptike lyne. myddest, hauyng. vi. degrees on every parte or side. And this lyne whiche diuideth into two equall partes the breadth or latitude of the Zodiack, is called the Ecliptike lyne, because that when the Sunne and Moone are directly diuided vnder this line, eyther loyned togeather by coniunction, or diuided by opposition, the is the Eclipse of the Sunne or of the Moone. Under this Zodiack the seuen planettes are moued. The Sunne also moueth in the myddst of the sayde Zodiack, alongest the Ecliptike lyne, not enelynyng more to the one part then to the other. But the other planettes doo sometime goe toward the North, and otherwhyles toward the South, and sometyme also toward the The mouing of the sunne, and the other planettes in the Zodiack. Ω trauerse the Ecliptike. It is lykewyse to be noted, of the sunne, that these signes wherof we haue spoken, are not the constellations or starres that make those figures, whiche the ancient Alchymists dyd appropiate to certayne beastes, and

The first part.

whil the xii. and other shynes. For these figures are mooued according to the motion of the eighth sphere, and passe from one signe of the Zodiack to another. As we see that the

The figures of beastes and other shynes are. The starre, called Oculus Tauri, (that is) the Bulles eye, is in two degrees of Gemini. And the two starres that are the head of Gemini, are in. xii. and xvi. degrees of Cancer. And Spica virginis, (that is) the spyke of the Virgin, is in the xii. signes. xvi. degrees of Libra. And the heart of Scorpio in two degrees of Sagittarius. And by this order doo they passe from one signe to another: so that we maye not vnderstande the signes by these starres, but so the xii. partes of the Arke of the Zodiack, takyng the begynning of the Equinoctiall of Aries. The names of these signes, with theyr caractes and qualites, are described in this table here followyng.

Numb.	Names	Charac.	Qualities.	Numb.	Names	Char.	Qualities.
1	Aries.	V	hot & drye.	7	Libra.	≈	hot & moist.
2	Taur.	ꝝ	cold and dry.	8	Scorpi.	m	cold & moist.
3	Gemini.	ꝝ	hot & moist.	9	Sagitt.	ꝝ	hot and dry.
4	Cancer.	S	cold & moist.	10	Capri.	ꝝ	cold and dry.
5	Leo.	ꝝ	hot and dry.	11	Aqua.	ꝝ	hot & moist.
6	Virgo.	ꝝ	cold & dry.	12	Pisces.	X	cold & moist.

The, xii, Chapter, of the Circles, called Coluri.



Here are two circles in þ sphere, called Coluri, so named of the Greke wylde Colon, which signifieth a member: And of Vros, whiche signifieth a wylde Dre. The tayle of this beast, maketh a Hemycircle or halfe Circle, not perfecte. And as this beast mooueth his tayle laterally or

syde wayes, and not by longitude: enso do the Coluri moue to vs, and are cut in ryght sphericall angles, vpon the Poles of the worlde. The one passeth by the Poles of the worlde, and by the pointes of the Equinoctials, and is called the Equinoctiall Colure: the other lykewyse passeth by the Poles of the worlde, and also by the Poles of the Zodiacke, and by the pointes of the Solstitialles, and is called the Colure Solstitiall, called Solstitium, as Solis statio (that is) the standing, or stayng of the Sunne; because that when the Sunne commeth to this poynt, it declineth no more, but returneth towarde the Equinoctiall. These circles diuide alswel the Equinoctiall, as the Zodiacke into four equall partes, by the poyntes of the Equinoctials, and Solstitials. In the Colure Solstitiall, the greatest declination of the Zodiacke, which are the Zodiacke, are the greatest declinations of the Zodiacke, two arkes of this Colure, conteyned betwene the Equinoctiall and the Zodiacke. And these arkes are equall to

the other two of the same Colure, included be-

twens the Poles of the worlde,
and the Poles of the
Zodiacke.

The Equi-
noctiall colure

The Solsti-
ciall Colure.

The xiii. Chapter, of the Meridian Circle.



The Meridian, is one of the great circles, imagined to traverse the sphere the Meridian by the poles of the worlde, cuttyng the same in two equall partes by the Zenith or vertical poynt. It is called Meridian for this effect: that wheresoever a man becometh, and at what soever tyme of the yeere, when the Sunne (by the mouyng of the syrl moueable) shall come to his Meridian: to hym shall it be hygh noone at The Midday day, and is therefore also called the circle of the Spiddar, or noone. It is

The first parte.

It is also to be noted, that there are as many Meridians, Divers Me- as are differences of habitations by ridians.

longitude: so that they that dwel in the East, haue other Meridians then they that dwell in the West: so that the interposition of the arke of the Equinoctial, betwene the Meridian of one citie, and the Meridian of the other, is called the difference of longitude from one region to an other, and from one citie to an other, as we wyl further declare hereafter.

¶ The xiii. Chapter, of the Hori- zontall Circle.

Definition of
the Horizon.



Hemisphere
of Horizon.

Divers Ho-
rizons.

The ryght
and oblique
Horizon.

The Horizon (after the Astronomers) is a Circle whiche diuideth that parte of the heaven which we do see, from the other part whiche we see not, so that the sayde Horizon diuideth the sphere of the worlde, into two equall halses, called Hemispheres. That halse which we do see,

is called the Hemisphere superior, and it whiche we see not, is called, the Hemisphere inferior. This Horizon, changeth to them that moue: for as one doth moue, his Horizon doth change. And hereof it commeth, that howe many places are vpon the earth, and the circumference thereof, it is possible there shoulde be so many Horizons. The Astronomers suppose the Horizon, after two maner of sortes, that is to say, a ryght Horizon, & an oblique, or crooked Horizon. The ryght Horizon, is to them whose Zenith or vertical poynt is directly in the Equinoctial: and this ryght Horizon, passeth by the poles of the world, and diuideth the Equinoctial in ryght spherical angles. The other oblique or declined Horizon haue they, vnto whom the pole of the world doth ryse aboue their Horizon. This Horizon is also called oblique, because it diuideth the Equinoctial, in unequall and oblique, or crooked angles.

Also

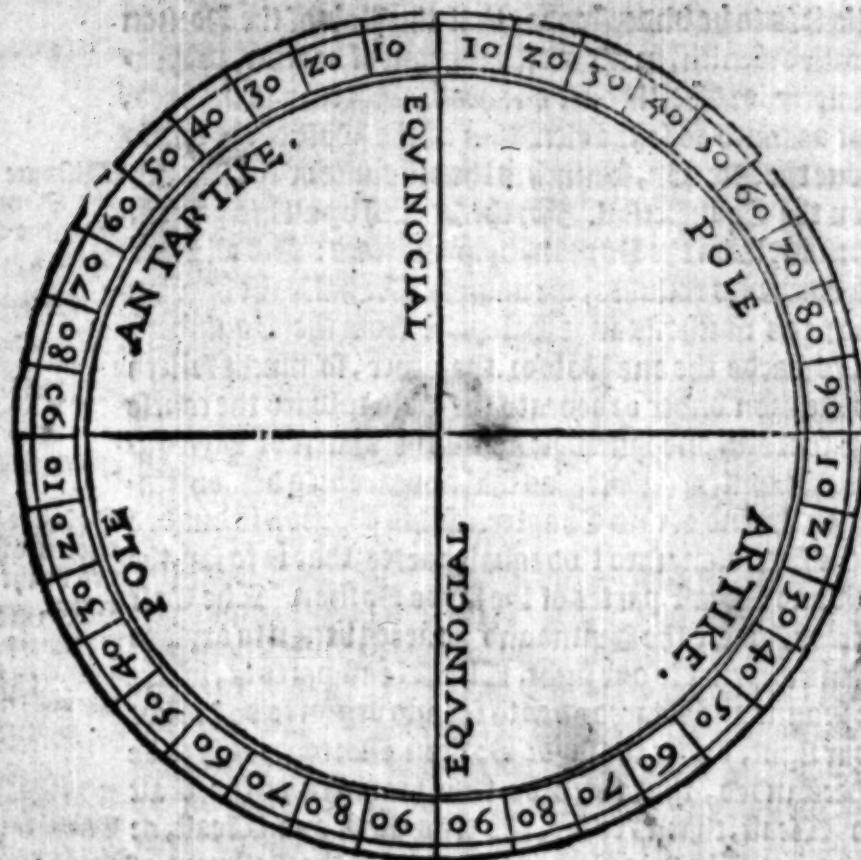
Also it is to be vnderstoode, that the Pole of the Horizon
is called Zenith, or the verticall poynt of heauen, perpen-
dicularly, or directly ouer our head. Wherby is inferred,
that as much as is the elevation of the Pole of the world
aboue the Horizon, so much is the distaunce of the Zenith
from the Equinoctiall. For the Zenith by all his partes,
is distant from the Horizon, by 90. degrees. And all other
impediments excluded, we may euer see halfe the heauen.
And in as muche as anye shall passe from the Equinoctie
all, towarde the one Pole or the other, so muche falleth
his Horizon vnder or beneath the Pole, toward the course
he intendeth, and lykewyse as muche shall it be raysed a-
bove the contrary Pole, as shal appeare by a demonstra-
tion in the end of this Chapter. This Horizon is diuided
by the Meridian, into two equall partes, that is to say, the
East and West parts of the sayde Horizon. The East
parte is, where the Sunne and Starres begyn to aryse to
vs, and appeare to our sight. The West parte is, where
the Sunne and Starres dooth set and begyn to be hid out
of our sight, vnder the sayde Horizon. Moreover, it is to be
vnderstood, that there be two manners of the East
and West, that is to say, the true East and West, or
the vntrue. The true East, is the poynt in the East part
of the Horizon, where it dooth cut with the Equinoctial: so
when the sunne is in the poyntes of the Equinoctials, then
he ryseth in the poynt of the true East. And lykewyse is
to be vnderstood of the poynt of the true West, to be in
the West parte of the Horizon, where the Equinoctiall
dooth cut with the sayde Horizon. The vntrue East and
West is variable, accordaning as the sunne ryseth and set-
teth dayly in divers poyntes of the Horizon, whiche is di-
stant from the poyntes of the true East and West, some-
tymes more to the Northward, and sometymes more to
the South.

Distance of
the Zenith
from the Equi-
noctial.

How the Ho-
rizon is diui-
ded by the me-
ridian.

The true and
vntrue East
and West.

The first part.



The xv. Chapter, of the four
lesse Circles.

The lesse
Circles.



Gyng entreated of the vi. biggess Circles,
it remaineth to speake of þ. iii. lesse Circles.
A lesse Circle (as we haue sayde before) is
that, whose superfical diuideth the Sphere
into vncquall partes, not passing by the
center.

center thereof. And of these, two are named Tropykes, so named of Tropo the Greke word, which signifieth conversion: because the Sunne coming to any of these Tropykes, is converted, and turneth toward the Equinoctial. These Tropykes are descriyed by the motion of the first moueable, with the pointes of the Solstitials. The one with the beginning of Cancer, and this is called the Tropyke of Cancer, or Estival, or sommer Tropyke. The other is descriyed with the beginning of Capricorne, & is called the Tropyke of Capricorne, or Vitemall, or wynter Tropyke. These two Tropykes and the Polar circles (whereof I wyl say more hereafter) are called Paralles: so named, so that they are equally distant by Paralles, theyz circumferences one from an other, and aswell from the Equinoctiall. The Polar circles are descriyed in this maner: so that as the Zodiacke declineth from the Equinoctial, so do the poles of the Zodiacke decline from the poles of the worlde. And as the eyght sphere is moued at the motion of the first moueable, so shall the Zodiacke moue, which is part of this sphere. And the Zodiacke beyng moued, his poles shall lykewyse moue about the poles of the worlde. And as the poles of the Zodiacke are distant from the poles of the worlde .xxiiii. degrees and a halfe (whiche is asmuche as the greatest declination) they shall descriybe certayne circles distant from the poles of the worlde, in the selfe same .xxiiii. degrees and a halfe. These Polar circles, take their name or domination of that pole of the worlde that is most neare unto them, and therfore is the one called Artyke, and the other Antartyke.

The poles
circles.

The poles of
the Zodiacke,
and poles of
the worlde.

The greatest
declination of
the Sunne.

Pole Artyke,
and Antart-
yke.

*The.xvi. Chapter, of the fyue
Zones,

The first part.

The sphere
dividid into
syue Zones.

Zones habi-
table and vn-
habitable.

The diuision
of the earth
accordyng to
the syue zones
of heauen.

In errour of
Ptolomie and
the Astrono-
mers.



He auncient Astronomers diuided the sphere into .v. Zones. The synt, from the pole Artyke, to the circle Artyke. The second, from the circle Artyke, to the Tropyke of Cancer. The thyrd, from the Tropyke of Cancer, to the Tropyke of Capricorne. The fourth, from the Tropyke of Capri-

corne, to the circle Antartyke. The fift, from the circle Antartyke, to the pole Antartyke. Of these .v. Zones, they had certayne knowledge, that two of the poles were vnhabitable for extreeme colde: and also that the burnt Zone (called Torrida Zona) wherby the Sunne passeth by the myddest of them, shoulde be vnhabitable for extreeme heate. That from the Tropyke of Capricorne, vnto the circle Antartyke, they called deserte, because they knewe not that it was inhabited. And this our Zone, that is, from the Tropyke of Cancer, to the circle Artyke, they called inhabited or habitable. And to have more perfect knowledge hereof, it is to imagine, that the earth is diuided proportionally into .v. regions or portions, whiche auncil were directly to the sayde syue Zones, as sayth the Poete Duid in this verse.

Totidemque plage, tellute præmuntur, that is. And so many regions, are on the earth beneath.

Every of these regions or portions of the earth, is situate vnder one of the syue Zones aforesayd. But wheras certayne men of autoritie haue moued the question, whether the earth vnder the Zone, from the Tropyke of Cancer, to the circle Antartyke, is deserte or no: Ptolomie, and the Astronomers affirme, that is vnpeopled. But Aristotle, Duid, in the second of his Metamorphoses, Pline also, and John De Sacro bosco, affirme the contrary: Es for the more certayntie therof, we knowe by therperiance of suche as go and comme dayly from those partes. Moreouer then this, we knowe that that lande is not on- ly well replenished with people of good corporature, and of whyte colour, but the same to be also very rych in gold. For they that sayle to y Cast Indies, touch in the cape of Buena

The first parte.

Buena speranza o; Caput bonæ Spei, whiche is in this ^{The lande of} zone. Likewise the lande of Brasiile, & the confines of Rio Brasiile. de la Plata, with al the coast, vnto the straights of Magalanes, even vnto the .lxxij. degrees of the South parte.

This land was discovered by Magalanes, in yere 1510. 01. 1521. whereby that is nowe well knownen by sight, whereof Ptolome had no knowledge by heare say. The burnt zone (called Torrida zona) they also described to be vnhabitable, by reason of the great heate thereof, as Ari-

The Straights of Magalanes.

otle, Plinte, and in maner all other auncient authours affyrmē: whereof the Poet Virgil wryteth thus.

Quinque tenent cœlū z onæ quarū vna corrusco.
Semper sole rubens: et torrida semper ab igne.
Whiche in the English tong, is thus much to say in effect.

In zones five, the heauens conteyned be,

Whereof the one with burnyng sume is red:

Scorching so the earth subiect to his degree,

That so; the heate thereof it is vnhabited.

Lykewyse Dasde in his Metamorphoses, toucheth the same, saying.

Quarū que media est, & torrida sēper ab igne. &c

Yet that the burnt zone is inhabited, and well replenis-
thed with people that lyue there, we knowe so certaynly ^{The west In-} by the number of them that dayly passe to and fro the In-

dies of your Maiesty discovered, in your most happy daies,

that to say any thing to the contrary, it shoulde bee a man-
fest errore. And therefore is it greatly to be mardeyled,

that certayne wryse men haue affyrmēd these partes to be
vnhabitable: whereas neverthelesse they had knowledge

of Arabia, Fœlix, Aethiopia, Taprobana, and dyuers o-
ther Regions situate vnder the burnt zone. Plinie wry-

teth, that a shyppe came from the Sea of persia by the
cean, rounde about Ethiopia, and came to the pillars of

Hercules, whiche is nowe the Cittie of Cadiz, where at ^{People of long} lyse under the
this present I wryte this brefe treatise. They of Guineea,

Calicut, Gatigara, and Malaca, lyue all vnder the burnt
zone, and many of them lyue very long. And doubtlesse,

many thinges ought to perswade vs, that vnder the burnt

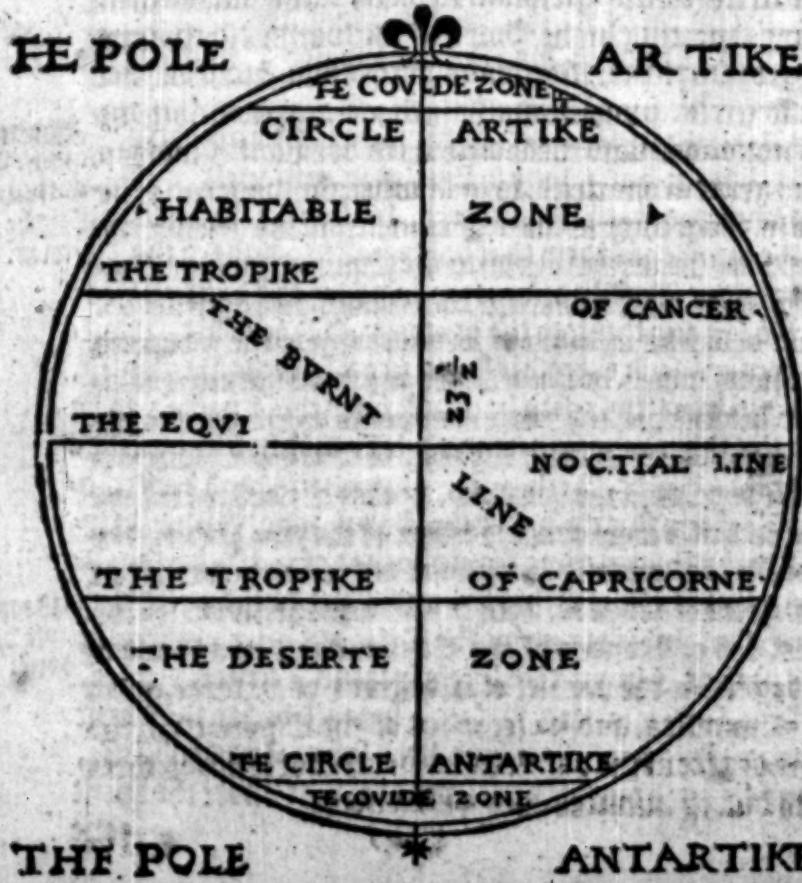
The first part.

Cold regi-
ons habitable.

Islande.
Gothlande.
Norway.
Russia.

zone, the earth is furnished with all thynges pertaining to the lyfe of man: soz that in that region, oþ portion of the earth, is in maner continuall & quinoctiall, and the coldnesse of the myght doth suffisently temper the heate of the day. Agayne, they that inhabite vnder that zone, haue two sommers, and two wynters in the yeare; wherby is concluded that the auncient authours erred, not only in assyning this zone to be unhabitable by reason of the great heate thereof, but in lyke maner erred, in assyning the zone that is betwene the circle Artike, and the pole Artike, to be also unhabited by reason of great cold. The contrary wherof, we maye wel assyrene, knowyng as we knowe, that Islande, with part of Gothlande, Norway, Russia, and dyuers other landes are inhabited and well peopled.

This is the figure and demonstration whiche foloweth.



**The xvii. Chapter, of longitude and latitude,
and of the proportion whiche the lesse circles
hauet to the great circle.**



The sphere or globe of the earth, is also divided in breadth, & in length. The breadth (which is called latitude) is by degrees: for from the Equinoctiall, to either of the two poles, is 90. degrees. The length (whiche is called longitude) is by the degrees of the Equinoctiall, which is divided in 360 degrees. The firste degree of longitude, doth begin at a certayne Meridian, which passeth by the Ilandes of the Canares, called the fird Meridian: and the order of the numbering of the said longitude, is alwayes toward the East. By every degree of the sayde longitude in the Equinoctiall, maye be understanded a great circle (called Meridian) to passe, eache one of them passing & meeting in the Poles of the world, so that the said great circles, or Meridians, doth diuide every paralel or lesse circle, proportionally into 360. degrees: but we must not understand these degrees to be equall (that is to say) as great in one circle, as in another: for the greater the circle is, the greater is the degree in it: and the greater the paralel is, the nearer it is unto the Equinoctial line. Every degree of the Equinoctial, conteyneth in longitude 60. minutes, so likewise it is to be understood of $\frac{1}{2}$ degrees of latitude, which be diuided each one in 60. minutes of latitude, because the degrees and minutes in the greater circles, do not differ in their bignesse the one from the other: but the degrees in the paralels, as they are distant fro the Equinoctial, & come neare to either of the two poles, they diminish consequently, so that one degree in the paralel of 12. degrees of latitude, doth make in quanttie but .59. minutes, and .33. secondes of the Equinoctiall circle: and to one degree in the paralel of 12. degrees of latitude, goeth but .58. minutes, and .41. secondes of the Equinoctial, and to one degree in the paralel of 15. degrees of latitude, therer goeth but .57. minutes, and .41. secondes.

The division
of the sphere
by longitude
and latitude.

The degrees
of the Equinoctial circle.

The first parte.

The table of minutes, whiche euery degré
conteyneth in euerye of the paralles.

G	9	5	G	9	5	G	9	5	G	9	5	G	9	5	G	9	5	G	9	5
1	59	59	16	57	41	31	51	26	46	41	41	61	29	5	76	14	31			
2	59	58	17	57	23	32	50	53	47	40	55	62	28	10	77	13	30			
3	59	55	18	57	4	33	50	19	48	40	9	63	27	14	78	12	28			
4	59	51	19	56	44	34	49	45	49	39	22	64	26	18	79	11	27			
5	59	46	20	56	23	35	49	9	50	38	34	65	25	21	80	10	25			
6	59	40	21	56	1	36	48	32	51	37	46	66	24	24	81	9	23			
7	59	33	22	55	38	37	47	55	52	36	56	67	23	27	82	8	21			
8	59	25	23	55	14	38	47	17	53	36	7	68	22	29	83	7	19			
9	59	16	24	54	49	39	46	38	54	35	16	69	21	30	84	6	16			
10	59	5	25	54	23	40	45	58	55	34	25	70	20	31	85	5	14			
11	58	54	26	53	56	41	45	17	55	33	33	71	19	32	86	4	11			
12	58	41	27	53	28	42	44	35	57	32	41	72	18	32	87	3	8			
13	58	28	28	52	59	43	43	53	58	31	48	73	17	33	88	2	5			
14	58	13	29	52	29	44	43	10	59	30	54	74	16	32	89	1	3			
15	57	57	30	51	58	45	42	26	60	30	10	75	15	32	90	0	0			

The. xviii. Chapter, of the circuite or compasse
of the earth and water, accordanctyng to the opinions
of the auncient and latter ancthours.



Myles.
Furlonges.
Leagues.

It may here appeare to be necessary for our purpose, to declare what space of the superficie of the earth or water, the auncient writers dyd suppose to answere to one degré of a greater circle in the heauen: for in divers countreys, they vsed to count by divers sortes or manner of mea-
sures: as, the Latines counted by myles: the Grekes, by furlonges: the Spaniardes and Frenchmen, by leagues: the Egyptians, by signes or markes: and the Persians,
by

by sagmas. But they all agree, that fourt graine of barley make a synger breadth, fourt syngers, a bande breadth, fourt bandes a foote, syue foote, a Geometrical pase (for two simple pases, make syue feete.) Also. 125. Geometrical pases, make a furlong. viij. furlonges, one myle, which is a thousande pases: and three myles, one league. In Germanie they make leagues of more feete, and in some places more then in other. In Fraunce, they count .xxx. leagues, to one degree. The Spanyarde, count. .xvj. leagues and two terces, and .xvij. and a halfe for a degree of the great circle: this difference that one league is bigger then another, may come hereof, that one barley corne is bigger then another. But to our purpose, let vs geue to every leaguer thre thousande pases, and to every pase sixt foot, and so shall every league haue. .xvj. thousand foote. In the Cardes of the sea, that haue they degrees of .xvj. leagues and two terces, we say, that of these, the roundnesse of the lande and the water, conteyneth six thousande leagues. And in the Cardes that haue .xvj. leagues and a halfe for a degree, of these we say that it conteyneth six thousande and three hundredth leagues. And who so desyreteth to knowe howe much is the Diameter of the earth and water, maye knowe it by multiplying the circumference by seven, so that dividing the summe that ryseth thereof by twenty and two, the part that ryseth of that calenlation, shalbe the Diameter: and the halfe thereof, shalbe the semidiameter.

The degrees
of the sea
cardes.

The Diamet-
er of the earth
and water.

The xix. Chapter of the seven Climates.

The ancient authours dyd also diuidre that part of the superficie of the earth, on the North syde of the Equinoctial, which they supposed to be more habitable, into seven Climates, wherein they did finde to be divers conditions and customes of men, and diversitie of beastes, and of other natural things: the whiche thinges they perceaued to haue a diversitie in the countrey, as

Division of
the earth and
water by cli-
mates.

Diversitie of
thynges in di-
uers climates.

The first part.

Where the day of the one dyb increase or differ, above the day of the other by halfe an houre, so that the space of the superficial of the earth betwene two parallel lines, where in the longest day doth increase or differ by halfe an hour, is called a Climat. The place where they suppose the first

What is a climat.
Difference
of dayes.

Climat to begyn, is distant in Latitude from the Equinoctial by .12. degrees and .45. minutes, where the longest day is .11. houres, and .45. minutes, & the place where the last Climat doth finishe, is in the Latitude of 50. degrees,

The space of
seven climates

and .30. minutes, where the longest day is .16. houres, and .15. minutes, so that the increase of the longest day in the ende of the seventh Climat, doth exceede it in the begynnyng of the syxt Climat, by thre houres and one halfe;

and the whole compasse of the earth, with al the seuen Climates, doth conteine in breadth .37. degrees, .9.45. minutes, but their length is supposed to extende to .180. degrees of longitude. In that maner, a Climat, the nearer it is unto the Equinoctial, the more it conteyneth of the superficial of the earth, because the parallel circles, the nearer they be unto the Equinoctial, the greater is the compasse of the earth whiche they make in length, & the lesser the compasse is, the nearer they be unto the poles, as doth appere evidently by the Meridians, where they do all concurre, and meet in the poles, their distances wareth continually lesser & lesser, the nearer they be unto the sayd poles, so that the nearer the Climat is unto the pole, the lesser it conteyneth of myles in the length. In lyke maner shall you understand, that greater is the breadth of the first climat, then of the seconde, and the seconde then the thirde, and lyke-lykle of the other. For in howe much the more the Equinoctiall you come neare to the pole, so muche the more is the spere oblique or crooked, and consequently the daye increaseth more: by reason wherof, in lesse space is found the increase of halfe an houre, in whiche the Climat maketh difference and doth varye. Whiche thyng shall be more manifest to hym that beholdeth the latitude of them all, as may appeare by the Table here folowynge: In whiche you may see the houres whiche the greatest daye conteyneth of every climate in his beginning, myndess;

The quanti-
tie of the lesse
circles.

and in howe much the lesse daye increaseth, in whiche the Climat maketh difference and doth varye. Whiche thyng shall be more manifest to hym that beholdeth the latitude of them all, as may appeare by the Table here folowynge: In whiche you may see the houres whiche the greatest daye conteyneth of every climate in his beginning, myndess;

The latitude
of Climates.

and in howe much the lesse daye increaseth, in whiche the Climat maketh difference and doth varye. Whiche thyng shall be more manifest to hym that beholdeth the latitude of them all, as may appeare by the Table here folowynge: In whiche you may see the houres whiche the greatest daye conteyneth of every climate in his beginning, myndess;

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and in howe much the lesse daye increaseth, in whiche the Climat maketh difference and doth varye. Whiche thyng shall be more manifest to hym that beholdeth the latitude of them all, as may appeare by the Table here folowynge: In whiche you may see the houres whiche the greatest daye conteyneth of every climate in his beginning, myndess;

and ends, with also the elevations of the Pole, or distance from the Equinoctiall, and also the degrees of latitude, whiche every climate contyneth.

Climates	The longest day.					The elevation of the pole. Differences				
	Beginning	Mid	Ende	Beginning	Mid	Ende	of y latitude			
	Ho.	W.	Ho.	W.	Ho.	W.	Ho.	W.	Ho.	W.
Fyfthe.	12	45	13	0	13	15	12	45	16	40
Seconde.	13	15	13	30	13	45	20	30	24	15
Thirde.	13	45	14	0	14	15	27	30	30	45
Fourth.	14	15	14	30	14	45	33	40	36	24
Fifteth.	14	45	15	0	15	15	39	40	41	20
Sixteth.	15	15	15	30	15	45	43	43	45	12
Seventy.	15	45	16	0	16	15	47	47	48	15
									40	30
									50	30
									30	15

The firste climate, is called Diameroes, Meroc is a citie Diameroes, of Aphrike, vnder the burnt Zone, on this side the Equinoctiall 15 degrees.

The seconde, is called Diasyena, Syena is a citie in the confines of Ethiopia, where there is a well that sheweth the Sommer solstitial, because that place is vnder y circle of the Tropike of Cancer, and the sunne seemeth to stand directly ouer that place at mydday of y solstitial, wherby the well is then very cleare, and hath in it no shadoine at all: as the Poet Lucan maketh mention in Farsalia, where he sayth.

Vmbras nusquam flectentes.

That is to say, shadowes no where reflecting.

The thirde, is, Dia Alexandros, Alexandria is a famous citie in Aphrike, buylde by great Alexander, & is the cheefecitie or Metropolis of Egypt.

The fourth, is, Dia Rhodos, Rhodes is an Ilande of Asia the lesse, where were sometyme the knyghtes of the Rhodes, called the knyghtes of the order of Saint John, or knyghtes of Jerusalem, who were driven from thence, when the Ilande and Cittie was taken by Soltan Suliman the greats Turke, in the yeare 1522.

Dia Alex
andros.

Dia Rhodos

Knights of
the Rhodes.
The Rhodes
taken by the
Turke.

The first parte.

Philippe Velerio Frenchman, being then grande master of the Rhodes: within this fourth clime, is the Cittie of Jerusalem, within the holy lande called Palestina, and also a great part of Iapayne, with many other provinces.

Dia Romes.

The syrth, is Dia Romes, Rome is the moste famous citie of Italie, and most notorius of al Europe, sometime the head of the worlde, dominatrix of nations, and nowe the sea of the Bishop of Rome.

Dia Boristhenes.

The syrth, is Dia Boristhenes, Boristhenes is a great ryuer of Scithia, the fourth arm of the ryuer Istro. It falleth into the sea Euxinum: and where as al other riuers of Scithia are troublid, this is cleare and sayre, also wholesome to be drunke, and full of fishe.

Dia rifeos.

The seventh, and last clime, is called Dia Rifeos: The mountaynes called Rife, are famous in the part of Europe, called Parmatia, and are continually covered with snoewe. Out of these, spryngeth the ryuer Tanais, well knowen in the worlde by fame. When it is wypeten with ph. it is the name of certaine mountaynes of Archadia. And here ought we not to be ignorant, that wheras the auncient authours assigned onely seven climates, they might haue made many more. And for that they judged the parte of the Pole Antartyke not to be inhabited, they assigned no climates thereto. Stoferine added the eygth climate, counting from thend of the seventh climate, unto 57. degrees: and other added more. In like manner describeng Meridional or South climates, we call them by the selfe same names, as we dyd the aforesayde Septentrional, or North climates: sauyng that it is necessarie to put before eny of them, this Greke preposition Anti, whiche in the Latin tongue, signifieth Contra, or Contrarium (that is) contrary, or agaynst. So that as we named the first North clime, Dia Meres, we must to the first of the South, add this woord Anti, and so shall the first South climate be named Anti Diameroes: The second, Antidia Siene, and so forth of the other, as is seene in the figure here folowyng.

Stoferine.

The Meridional or South climates.

POLE

ARTIC



The xx. Chapter, of certayne principles,
that ought to be knowen for this science.



In treatyng of the Spheare, we
have spoken of Circles, Cir-
cumferences, Centers, Diam-
eters, Lynes, with such other
woordes, appropriate to this
science: The whiche, what they
are, it is conuenient further to
declare.

A right lyne, is a shortheit
from point to point.

An angle, is the touchyng of lynes in one superficiall.

In angle.

Whose

The first part,

Wolde.

A circle.

The circum-
ference of a
circle.

The center
of a circle.

Diameter.

Semicircle.

Zenith.

Eccentricke

whose touch shal not be direct: for if it be, it shalbe a lyne, & not an angle. Wolde is a body, whiche by deuisions hath length, breadth, and depth.

A circle, is a playne figure, conteyned vnder a lyne drawen in compasse, in whose middest is a poynt or prick, from the whiche all right lynes comming soorth to the circular lyne that compasseith it about, are equal.

The circumference of a circle, is a lyne that conteyneth the circle, (that is to meane) that lyne to the whiche all ryght lynes that proceede from the center of the circle bnto it, are equal: & this is called the roundnesse of the circle.

The center of a circle, is that poynt or prick from the whiche al ryght lynes proceeding vnto the circumference, are equal.

The Diameter of a circle, is a ryght lyne, whiche passing by the center of the circle, and extensing his endes to the circumference, diuideth it in two halves.

The halse circle, is a playne figure conteyned betweene the Diameter of the circle, and the halse circumference.

Zenith, is a poynt or prick imagined in the heauen, directly over the top of any thing, as, if we shoude imagine a ryght lyne to passe by the center of the earth, extended from thence directly to heauen, and passing through the feete and head of a man standyng vp ryght, so that the extremities or endes of this lyne, shoule reache vnto, and touche the circumference of heauen: then the imagined poynt or prick of heauen, where the ende of the lyne toucheth, is called Zenith, or poynt of the head, or verticall poynt. The same is to be vnderstoode of a citie, or any other thyng, when we speake of the Zenith thereof.

Eccentricke, is a circle, whiche hath his center distant, or diuided from the center of the worlde, and is described in the heauen of the sunne, imagining a line from the center of the Eccentricke, to the center of the sunne, making a complete revolution at the proper motion of the sunne. In the other heauens, imagining a line from the center of his Eccentricke, to the center of his Epicicle: and brynging mooued a whole revolution at the proper motion of the Epicicle.

The

The first part.

The Epicycle, is a circle, or little roundel set in the Epicycle, a
depth of the Eccentrike: in which the Planet fixed, and
nearre to his center, is moued circulary.

The Auge, is a poyn: in the circumference of the Epicycle, a
centrike, nearest unto the firmament: or it may be sayd,
that the Auge is a poyn: fardest distant from the earth.
Auge in the Greek tongue, is as much to say, as the grea-
test longitude, or greatest elevation from the earth. The
Opposite of Auge, is an other poyn: in the circumference Opposite of
of the Eccentrike, nearest unto the earth, and furthest di. Auge.
distant from the firmament.

¶ Here endeth the fyfth part.

¶ The Seconde part, intreating of the
Motions of the Sunne, and the Moone,
and of the effectes caused thereby.

¶ The fyfth Chapter, of the course of the Sunne
in the Zodiacke, and of the effectes
caused by the same.


¶ We have briefly spoken of the Sunne
and of the other heauens. But so farre as
muche as the Sunne muste be our
marke, gyarde, and gouernour in Ma-
gination, whereof we intende to geue
perfect instructions, it shalbe necessa-
ry especially, and precisely, to declare
the course and motions thereof. Therefore (as we have
said) the sunne is moued vnder the Zodiacke, and vpon his
poles in the lyne Ecliptiche, passing by the xii. signes,
beginning in the first degree of Aries, wher he maketh
Equinot, that is to say, he maketh then the day equal tri-

The Sunne
is the gyarde
in Magination.

The moving
of the Sunne
vnder the Zodiacke.

The first part.

The sommer
Tropike.

Declination
of the sunne.

The wynter
Tropike.

The cause of
increasing and
decreasing of
the dayes and
nyghtes.

to the nyght in all places. Then from Aries he entreth and moueth into Taurus, approching nearer and nearer vnto vs on the North parte, whereby the length of the dayes are increased with vs, and the nyghtes are shortened. Then entreth he into Gemini, and from Gemini, into Cancer, where in the beginning of the first degree, he maketh Solstice, and toucheth the Sommer, or Estival Tropike, and then are the dayes longest with vs, and the nyghtes shortest. Then declineth he no further from the Equinoctiall: but returnyng towarde it, passeth by this signe, shortenyng the dayes to vs, and lengthenyng the nyghtes. From this signe of Cancer, it entreth into Leo, & passeth by it into Virgo, and by it entreth into the first degree of Libra, where he is in the Equinoctiall, & then he maketh the other Equinox, so that the nyght is then equal vnto the day ouer al the worlde. And passing by this signe, goeth declinynge from the Equinoctiall toward the pole Antartike, increasynge the nyghtes to vs, & shortenyng the dayes: and so entreth into Scorpio, and from thence into Sagittarius. And passyng by it, entreth into the syxt degree of Capricorne, to the Hyemal or Wynter Tropike: and then are the longest nyghtes vnto vs, and the shortest dayes. From hence he returneth towarde the Equinoctiall, shortenyng vnto vs the nyghtes, and lengthening the dayes. He passeth by this signe of Capricorne, and entreth into Aquarius: and passyng by it, entreth into Pisces: and passyng from thence, returneth to his syxt poynct of the Equinoctiall of Aries, wher he begayne. Herby it foloweth, that as the Sunne goeth the hals of the zodiache on this part of the Equinoctiall, and the other hals on the other part of it, & in these hals bath dyuers declinations, is caused the increasynge or decreasing of the dayes and nyghtes, to one more, and to another lesse, accordyng as every one with his Horizon discouereth of the course of the Sunne, by hylle or muche that he is departed or distant from the Equinoctiall, or as the pole is raysed above his Horizon. So that when as to them that are on this part of the Equinoctiall, is the longest day and the shortest nyght: even so to them

on the other part, is the longest nyght, & shortest day. And contrarywyse, when vnto vs is the shortest day, vnto them is the longest. Whiche shal further appeare by euident demonstration in the last chapter of the third parte.

The discrete Reader shal here note, that the sunne is The mouyng
not moued regularly in the Zodiacke, making so much of the sunne in
by his proper motion in one day, as in the other, because the center of
his regular motion is in respect of the center of his owne
proper sphere or oþre wherin he is moued, whose center
is distant without the center of the worlde, towarde that
part of Cancer, so that the greater parte of his oþre eccen-
tricke, is toward the septentrional parte, where the sunne
passing by the septentrional signes, is more distant from
the earth, and bath more to goe of his oþre eccentricke, then
beyng in þ South signes: for passing by the North signes,
he tarþeth 9. dayes more: to describe that halfe of the Zo-
diacke, then the other halfe toward the South part, and
for that cause the sunne is more swifter in his motion in
the Zodiacke one tyme then other, for his motion in one
day in the South signes, shalbe greater then it is in one
day in the North signes, as shal appeare in the table that
foloweth: whose vse is, for the finding of the motion and
true place of the sunne in the Zodiacke for every day of the
yeere. And hereby it foloweth of the sayde unequall mou-
yng of the sunne, and by the oblique of the Zodiacke,
certayne dayes of wynter, with theyþ nyghtes, are longer
then certayne other of Sommer, with theyþ nyghtes, that
is to say, that the day naturall in the wynter, dooth sur-
mount that in the Sommer, because the ryght assencion,
whiche auncweareth to one dayes motion of the sunne,
beyng in the South signes, is greater then the assencion
for one dayes mouyng, being in the North signes.

The

The second part,

The.ii, Chapter, of the true place of the
sunne in the Zodiack.

To finde the
true place of
the sunne.



The equation
of the yeres.

He true place of the sunne, is a
poynt or pricke in the Zodiack,
which is thus found: hat draw-
ing a ryght lyne from the center
of the wold, to the center of the
sunne, & carrying the same conti-
nually ryght forth vnto the Zo-
diacke, where this lyne sheweth
or toucheth, that is the true
place of the sunne. This place is founde in three manners.
One way, by a table: another way, by an instrument: and
the thryde way, by a certayne rule, to be boorne in memo-
rie. To finde the true place of the sunne by a table, seekes
in the table solowyng, the moneth that you are in, in the
fronte or head of the table, and the dayes of the moneth,
on the least side of the table. Then directly agaynst the
dayes, vnder the title of the monethes, you shal finde two
numbers, which are the degrees and minutes of the signs
whiche you shal first finde, named over the head, or aboue
the sayde numbers. Then to the degrees and minutes
whiche you shal finde, you shall adde the equation, that is
directly of the yere in the whiche you are, or seeke to know:
And this shal you seeke in the table of equations, which is
after this: and that whiche dooth amount or arise therof,
shalbe the true place of the sunne. And here is to be noted,
that in the common yeres, (whiche are they that haue
not the bisettile or leape yeres,) from the ende of Februa-
rie, vntyll the ende of the yere (I say of December)

Shall euer one degree be diminished or taken a-
way: and the degrees & minutes that shall re-
mayne, is the true place of the sunne. How
to know this by an instrument & by me-
morie, shalbe sayde in the seventh
Chapter,

The

The second part.

Fol. xxiiii.

The Table of the true place of the Sunne.

Moone.	January.	February.	Marche.	Apill.	May.	June.
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Signes	Caprico.	Aquarius.	Pisces.	Aries.	Taurus.	Gemini.
○	○	○	○	○	○	○
1	20	22	21	53	20	55
2	21	24	22	54	21	55
3	22	25	23	54	22	21
4	23	26	24	55	23	19
5	24	27	25	55	24	17
6	25	28	26	56	25	15
7	26	30	27	56	26	14
8	27	31	28	56	27	12
9	28	32	29	57	28	10
10	29	33	0	57	29	8
11	0	35	1	57	0	6
12	1	36	2	58	1	4
13	2	37	3	58	2	3
14	3	38	4	58	3	1
15	4	39	5	58	4	44
16	5	40	6	53	5	44
17	6	41	7	58	6	38
18	7	42	8	58	7	52
19	8	43	9	58	8	49
20	9	44	10	58	9	47
21	10	45	11	58	10	45
22	11	46	12	58	11	43
23	12	47	13	57	12	40
24	13	48	14	57	13	38
25	14	48	15	57	14	36
26	15	49	16	56	15	33
27	16	50	17	56	16	31
28	17	51	18	56	17	28
29	18	51	19	56	18	26
30	19	52	1	19	27	17
31	20	52	1	20	25	13

The second part.

The Table of the true place of the Sunne.

Moonth. | July. | August. | September. | October. | November. | December.

Signes	Cancer.	Leo.	Virgo	Libra.	Scorpio.	Sagitta.
O	G	P	G	G	G	G
z						
1	18	26	18	2	18	4
2	19	23	19	0	19	2
3	20	20	19	58	20	1
4	21	17	20	55	21	0
5	22	14	21	53	21	58
6	23	11	22	51	22	57
7	24	8	23	48	23	56
8	25	5	24	46	24	55
9	26	2	25	44	25	54
10	27	0	26	42	26	53
11	27	57	27	40	27	52
12	28	54	28	38	28	51
13	29	51	29	36	29	50
14	02	48	01	34	02	49
15	1	46	1	32	1	48
16	2	43	2	30	2	47
17	3	40	3	28	3	46
18	4	38	4	26	4	45
19	5	35	5	24	5	47
20	6	32	6	22	6	44
21	7	30	7	21	7	44
22	8	27	8	19	8	43
23	9	25	9	17	9	42
24	10	22	10	16	10	43
25	11	20	11	14	11	41
26	12	17	12	13	12	40
27	13	15	13	11	13	40
28	14	12	14	10	14	40
29	15	10	15	8	15	40
30	16	7	16	7	16	39
31	17	5	17	5	17	49

The Table of the Equations of the Sunne.

The yeres The equatio The The S. The The S. The yeres The equatio
of our Lord. to be added. n. The equation. yeres. quation. yeres. quation. of our Lord. to be added.

1545	14	1	0	1581	1	16	1617	1	32	1653	1	48	
1546			45	1582	1	1	1618	1	17	1654	1	33	
1547			30	1583		46	1619	1	21	1655	1	18	
1548			15	1584		32	1620		47	1656	1	3	
1549			1	21	1585	1	18	1621	1	33	1657	1	49
1550			47	1586	1	3	1622	1	18	1658	1	34	
1551			32	1587		49	1623	1	31	1659	1	19	
1552			18	1588		33	1624		49	1660	1	4	
1553			1	41	1589	1	19	1625	1	35	1661	1	51
1554			49	1590	1	4	1626	1	20	1662	1	36	
1555			34	1591		49	1627	1	5	1663	1	21	
1556			19	1592		35	1628		51	1664	1	7	
1557			1	95	1593	1	21	1629	1	37	1665	1	53
1558			50	1594	1	6	1630	1	22	1666	1	38	
1559			35	1595	1	51	1631	1	7	1667	1	23	
1560			21	1596		37	1632		53	1668	1	9	
1561			1	71	1597	1	23	1633	1	38	1669	1	55
1562			53	1598	1	8	1634	1	23	1670	1	40	
1563			37	1599		53	1635	1	81	1671	1	25	
1564			23	1600		39	1636		54	1672	1	10	
1565			1	9	1601	1	25	1637	1	40	1673	1	56
1566			54	1602	1	10	1638	1	25	1674	1	41	
1567			39	1603		55	1639	1	10	1675	1	26	
1568			25	1604		40	1640		56	1676	1	12	
1569			1	11	1605	1	26	1641	1	42	1677	1	58
1570			56	1606	1	11	1642	1	27	1678	1	43	
1571			41	1607		56	1643	1	12	1679	1	28	
1572			26	1608		42	1644		81	1680	1	13	
1573			1	12	1609	1	28	1645	1	44	1681	2	0
1574			57	1610	1	13	1646	1	29	1682	1	45	
1575			42	1611		58	1647	1	14	1683	1	30	
1576			28	1612		44	1648	1	61	1684	1	15	
1577			1	14	1613	1	90	1649	1	451	1685	2	2
1578			59	1614	1	15	1650	1	31	1686	1	4	
1579			44	1615	1	10	1651	1	16	1687	1	32	
1580			29	1616		46	1652	1	2	1688	1	8	

The seconde parte.

This Table of the Equation of the Sunne, serueth
from the yeere of 1545. where it bath his roote or begin-
nyng, vntyll 1580. and in the yeere of 1581. it shall re-
turne to the roote, adding thereunto one degree more.

Also; Example. In the yeere of 1581. adde one degree
vpon the other degree that the roote bath, and so shal the
yeere of 1581. haue two degrees of equation, and the
yeere of 1582. shall haue one degree, and .45. minutes,
whiche is to adde one degree vpon .45. minutes, that had
the yeere of 1545. &c. And hausing passed other 136. yeres.
you shall returne to the roote, addyng two degrees.

¶ The thyrde Chapter, of the declination of the Sunne.

What is the de-
clination of
the Sunne.



The declination of the Sunne, is the
arcke of the greater circle, whiche pas-
seth by the Poles of the worlde, inclu-
ded betwene the Equinoctial and the
Zodiacke. And here is to be noted, that
whatsoever fourte poynetes or prickes
whiche are equally distant from the
poynetes of Equinoctes (whiche are the
beginnynges of Aries and Libra) shall haue equall decli-
nations.

Wherof it foloweth, that the fourte quarters of the Zodiacke haue equall declinations. And to auoyde proli-
tie, I wyll adde hereunto a table of the declinations of
only one quarter of the Zodiacke, so that all hauing one
selfe same maner of declinations, it may serue for all, and
the order of it is this. The signes whose declination in-
creaseth, are in the head or fronde of the Table, and the
degrees of these signes descend by the left syde thereof.
And the signes whose declination decreaseth, are in the
foote of the Table, and the degrees of these signes, rysse
by the ryght syde of the same. The disposition of the Ta-
ble beying understande: then to knowe what declination
the Sunne bath in euery degree of the Zodiacke, you
eught to knowe the true place of the Sunne (as in the

Chapter

The second part.

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Sign.	V	VI	VII	VI	VI	VII	Sign.
nes.							nes.
S	S	S	S	S	S	S	
0	10		11	30	20	12	30
1	10	24	11	51	25	25	29
2	10	48	12	12	20	37	28
3	11	12	12	33	23	49	27
4	11	36	12	53	21	0	26
5	12	0	13	13	21	11	25
6	12	23	13	33	24	22	24
7	12	47	13	53	21	32	23
8	13	11	14	13	21	42	22
9	13	35	14	32	24	51	21
10	13	58	14	51	22	0	20
11	14	22	15	10	22	9	19
12	14	45	15	28	22	17	18
13	15	9	15	47	22	25	17
14	15	32	15	5	22	32	16
15	15	55	16	23	23	39	15
16	16	19	16	40	22	45	14
17	16	42	16	57	22	52	13
18	17	5	17	14	23	57	12
19	17	28	17	31	23	3	11
20	17	50	17	47	23	8	10
21	18	13	18	3	23	13	9
22	18	35	18	19	23	15	8
23	18	58	18	34	23	19	7
24	19	20	18	49	23	22	6
25	19	42	19	4	23	24	5
26	19	4	19	18	23	26	4
27	19	26	19	32	23	28	3
28	19	47	19	45	23	29	2
29	19	9	19	59	23	30	1
30	19	30	20	12	23	30	0
Sign.	X	III	222	82	26	155	Sign.
nes.							nes.

Chapter pastel is declared) for the day of y declination whiche you desire to know, and the signe whiche the sunne shal be found in that day, shal you seeke in the fente or foote of the table. And if it be in y fente, you shal seeke the number of the degrees on y least side. And if it shalbe at the foote of the table, you shal seeke it on the right side. Then aboue or vnder the signe, in the fente of that degree of the sayde signe, you shal finde two numbers, wherof the first is of degrees, and the seconde of minutes: and those degrees and minutes of declination the sunne hath that day. And this is vnderstoode without having respect to the odde minutes aboue the degree, whiche the true place of the sunne hath.

And yf you desire to verifie this more precisely, note the declination of

The seconde parte.

that degree, and of the degree folowing: and take the lesse from the moare, and that whiche remayneth shalbe the difference of the declination from the one degree to the other, of whiche difference ye shall take a parte proportionally as are the minutes of the place of the sunne vnto. 60. And this part of minutes must be added to þ first declination of it, and be lesse then the second, or must be taken from it if it shalbe greater, and then that riseth therof, shalbe the precise declination for that signe, degree, and minute. As for example. In the yeere 1545 the tenth day of September, the sunne shalbe in. 26. G. 38. M. of Virgo, & to the 26. G. precise, shal correspond. 1. G. 36. M. of declination. And to verifie the declination that commeth to 38. minutes, whiche is moare of the 26. G. you must marke the difference that is from the declination of. 26. G. (whiche is one G. 36. M.) to the declination of. 27. G. whiche is. 1. G. 12. M. The difference is. 24. M. Of these you must take such part proportionally, as the 38 minutes beareth vnto 60. which are almost two terces of a degree. Then the two terces of. 24. are. 16. which must be taken from one degree. 36. M. which correspond to the. 26. G. of Virgo, because the declinations go decreasing, & remayneth. 1. G. 20. M. and if the declinations increase, you muste adde thereto, as you take awaies when they decrease.

An other example for this yeere of. 1561.

Example for the yeere. 1561. the. 20. of April, I find þ true place of the sunne at noone, in. 9. degrees. 54. minutes of Taurus: then in the table of signes present, I seeke for the 9. degree of Taurus, to whiche dooth answere for the declination. 14. degrees. 32. minutes, & to the next degree following, doth answere. 14. degrees. 51. minutes: then take the lesser out of þ moare, so resteth. 19. minutes. Then frame a rule of. 3. & say, if. 60. minutes geue. 54. minutes (whiche 54. minutes dooth rest before of the. 9. degree of Taurus) how many doth. 19. minutes geue, whiche. 19. minutes are þ diversitie of the. 9. and. 10. degrees of Taurus. So I finde that. 19. minutes geueth. 17. minutes, & 6. secundes, whiche 17. minutes, & 6. secundes, I adde to the. 14. degrees. 32. minutes, whiche answereþ to the. 9. degrees of Taurus.

And

And that commeth to 14. degrees 49. minutes, and 6. secondes, whic is the true declination for the 20. daye of Apryll. Anno. 1561.

It is also to be noted that I adde these 17. minutes, and 6. secondes, because the declination doth encrease: for ye it decreased, it were to be taken out so much, and the rest is the declination, so is the declination for the 20. of April, in the yere 1561. 14. degrees 49. minutes, and 6. secondes.

The .iiii. Chapter, of the entraunce of the Sunne into the .xii. signes. And of the Equinoctials, and Solstitials, which diuide the fourt tymes of the yere.



If that is sayde in the Chapter before, it followeth, that the Sunnes entryng into the fourt principall signes, causeth the fourt tymes of the yere. For entryng into Artes, it chaungeth the tyme to vs from Wynter to the spryng tyme. And entring

The entraunce
of the Sunne
into the fourt
principall
signes.

into Cancer, it chaungeth the tyme from spryng to Sommer: and entryng into Libra, from Sommer to Autumne. Lyke wyse entryng into Capricorne, it chaungeth from Autumne to Wynter. So that when to vs that be on the part of the North, is Sommer, then is it Wynter to them that are in the South part. Or con-
trarywyse, beynge Sommer to them on the South, it is Wynter to them on the North. The entraunce of the Sunne into these signes, and all other of the Zodiacke, hath not ben ever at one selfe same tyme of the yere. The cause of this is, that the Latin yere is not equall

The Latin
yere.

with the mouyng of the Sunne in the Zodiacke, as shalbe sayde in the .x. Chapter, where we wyll entreat of the yere. In the tyme that Christe our redeemer was borne, were the Equinoctiales. The one at the .viii. of the Kalendas of Apryl, and the other at the .v. of the Kalendas of Christes birth.

The seconde parte.

The Hulst. tial.

lendes of October : so that they had the Equinoctial of the spryng at the xrb. of Marche, and the Equinoctiall of Autumnne, at the xxvii. of September, as wryteth John Baptis Capuano vpon the seconde Chapter of the Sphere of Iohan. de sacro bosco. They iudged then the Hulstials: as that of the Sommer, at the eyght daye of the Kalendes of Iulye, whiche is the .xxiiii. of June: the other of the Wynter, they iudged at the eyght daye of the Kalendes of January, whiche is the .xxv. of December. And here wyll I not omitt to saye howe in those tymes, at these fourre dayes (that is to meane, in the two Hulstials, and two Equinoctials) were celebrated, or dyd chancie fourre marueilous thynges in the worlde.

Fourre notable thynges.

For in the spryng Equinoctiall, whiche was at the xrb. of Marche, the Sonne of God was incarnate, and afterwarde borne of the Virgin Marie in the Hulstiall of Wynter, whiche was at the xrb. of December. In the Equinoctiall of Autumnne, which was the .xxvii. of September, was conceaved blessed John Baptis, the cryer and precursor of Christ, and was borne in the Sommer Hulstiall, that was the .xxviii. of June. And this is the fift moneth, whereof S. Luke speaketh in the Gospell. Whiche thyng also John Chrysostome doth verifie, saying, that S. John was borne when the dayes began to decrease: and our Lorde when they began to increase. And it may certaynely seeme woorthy to be had in memorie, that in the sayde Equinoctiall of the spryng, Christe suffered, Adam was created, and loste the estate of innocencie, Abell was slayne, Melchisedech offered breade and wyne, Isaac by Abraham was brought to be sacrificyd, John Baptis was beheaded at Macherunta, Peter de lyuered out of pryson, Sainct James beheaded by Herode, the good thesse enjoyed Paradyse, and the bodyes of many saintes rose with Christ. And who so further desyreteth more precisely to knowe the entraunce of the Sunne into Aries, and into the other principall signes, shall in the thyrdre parte of this woorke in the .viii. Chapter, synde rules whiche shall bryng hym to the knol-
ledge

To knowe
more precisely
the entraunce
of the sunne in-
to the fourre
principall sig-
nes.

ledge thereof. But to returne to our tyme, I saye, that this present yere of. 1545. the sunne entreth into the firste degree of Aries, at the tenth of Marche, at foure of the clocke at after noone: and into the firste degree of Taurus, the nyght of Aprouill. 20. houres, and seuen minutes. And into Gemini the ii. of Maye, two houres, and syre minutes. Into Cancer, the ii. of June 14. houres. 44. minutes. Into Leo, the ii. of July. 3. houre. 50. minutes. Into Virgo, the ii. of August. 9. houre. 56. minutes. Into Libra, the ii. of September. 4. houre. 4. minutes. Into Scorpio, the ii. of October. 7. houre. 13. minutes. Into Sagittarie, the ii. of November, iuste at noone. Into Capricorne, the ii. of December. 8. houre. 16. minutes. Into Aquarius, the ii. of January. 2. houre. 1. minute. Into Pisces, the ii. of Februarie. 1. houre. 30. minutes after mydday, (that is to saye) from noone. 1. houre. 30. minutes. And that we maye in the yeres to come, knowe the daye, houre, and minute, in the whiche the sunne entreth into everye signe, we wyl folowe this order. Upon the dayes, houres, and minutes, that the sunne entreth into everye signe this sayde yere. 1545. we muste adde for everye yere, syue houres, and 49. minutes, which with the 365. dayes, whiche every yere com-
teyneth, shalbe the tyme in the whiche the sunne accom-
plissheth his revolution. And because that in the yere of the bisertile or leape yere, is added to Februarie one day more to his. 28. whiche he hath once in four yeres from. 6. to. 6. hours, ys we shall take from the computa-
tion, that whiche we haue genen hym, turning one daye backward (as shalbe in the yere. 1548.) and vpon that that remayneth, shall returne in the yere fol-
lowyng of. 1549. to adde syue houres. 49. minutes, and as muche more every other yere folowyng, shalbe a certayne rule for ever.

And it is to note, that the degrees and minutes whiche we haue touched before, are properly for the citie of Cadiz, and ys we desyre to applye them for other citiis or places more Eastwarde: then for everye rv.

To knowe
when the
sunne entreth
into everye of
the xi. signes.

Leape yere.

The second part.

Variation of
houres by the
rapte mouyng
of the Sunne
from East to
weast.

degrees that they are distant from Cadiz in longitude, we
must adde one houre. And yf for Cities or places more
to the eastward, in lyke manner for euerie 15. degrees, we
muste take away one houre, by reason of the course of the
Sunne, by his rapte mouyng from the East to the West:
For it is certayne, that when with vs in Cadiz it is .xii.
houres of the clock, to them that are 15. degrees Eastward
from vs, it is one of the clocke: and to them that are from
vs .xv. degrees to warde the West, it is .xi. of the cloke.

Nowe that we haue rules to knoue the entraunce of
the Sunne into the .xii. signes, thereby may we also know
his entraunce into the four Cardinal or principal signes,
whiche are they that determine and ende the Equinocti-

The entrance of
the sunne into
the .xii. princi-
pall signes,
causeth the
change of time
alles and solstitialles, wherby are caused the four times
of the yeare. And for as muche as the generall chaunge
of tyme, is, by reason of the Sunne, who by his comming
neare, warmeth: by his remaynyng, dryeth: with his de-
parture, cooleth: and by his long taryng away, causeth
moystnesse, we wyll shewe the qualites of the principall
wyndes, elementes, regions, humours, and agies, in one
breefe table, and then consequently in another wyll we de-
scribe the begynnyng, mydd, and ende of the four times
of the yeare, as well in the monethes, as in the heauenly
signes.

The Table of the qualities of the Clementes.

Qualties.	Hot & drye.	Hot & moist.	Cold & moist.	Colde & drye.
Partes of the yere.	Sommer.	Spryng.	Wynter.	Autumne.
Principal wyndes.	East.	South.	West.	North.
Clementes.	Fyre.	Ayre.	Water.	Earth.
Regions.	East.	South.	West.	North.
4. Humours.	Choler.	Blood.	Fleame.	Pelancholy.
4. Agies.	Youth.	Manes state.	Aged.	Age.

The Table of the four tymeſ of
the yere.

Ymes.	Begynnyng.	Middell.	Ende.
Spryng.	Marche. Aries.	Apill. Taurus	May. Gemini
Sommer.	June. Cancer.	July. Leo.	August. Virg.
Autumne.	Septemb. Libra.	Octob. Scorpio	Novem. Sagit.
Wynter.	Decemb. Capricor.	Janua. Aquar.	Febr. Pisces.

The v. Chapter, of the moone, and
of her motions and properties.

¶ the Chapters past of this secondes
 parte, we hane entreated of the sunne, The sunne
 and of his motions & effectes, as the the principall
 most noble and principall luminarie, luminaries,
 In this present Chapter, we wyll in-
 treate of the moone, whiche is the se-
 cond luminarie, although in the order
 of the beauens, she is first and nearest vnto vs of al other
 planettes or starres. The moone therefore is a round body,
 of heavenly substance, solide and darke in respect of the
 sunne, having no proper lyght of her owne, but is apte to
 receaue lyght. She is moued from the West into the
 East, according to the order of the signes every day. 13. de-
 grees, little more or lesse, and somewhat more then. 10. mi-
 nutes, by the proper motion of the heaven or sphere vpon
 the axis & poles of the zodiack. I say more or lesse, because
 that ouer and besyde the mouing of her deferent or circle,
 which is moued every day the aforesaid. 13. degrees, and r.
 minutes, almoste. 11. She hath an Epicycle, wherethe moone
 is moued: at the motion wherof, sometimes she is moued
 more swifly, & sometimes more slowly. Neverthelesse, ac-
 cording to her mid motion, she maketh her course in. 27. The Epicycle
 dayes, and almoste. 8 hours: and having no light of her the sunne.
 owne, she is lyghtened of the sunne, as manifelilly appea-
 reth hereby, that being in coniunction with the sunne, or
 neare vnto hym, we see her not lightened, because the The coniunc-
 lyght whiche she then receaueth, is onely by her upper-
 moste or hyghest parte, wherby she directly beholdereth the light of the
 sunne, sunne.

1111.107
The second part.

Sunne, so farre as muche as he is in the fourth heaven, and she
in the firste. And departyng from the sunne by her proper
moouyng, the Sunne remayneth on the West part.

The aspect of
the moone to
the sunne.

Then towarde that parte we begynne to see a lytle of
the parte of the moone lyghtened; and so more and more
by little and little, as she departeth further from the sunne.

And at this tyme she bath her hornes or corners toward
the East, because the sunne is in the West. Duryng this

The increa-
sing and oppo-
sition of the
moone.

tyme also, she is saide to increase, or that she goeth increa-
sing vnto the opposition whiche we see by the part of her,
whiche the sunne directly beholdeth; and so doo we see her

altogether lyghtened, and call it the full moone. Then
passing from the opposition, she commeth nearer the
sunne by little and little, beynge darkened and hidde from
us, and lyghtened onely by her highest parte, and this
tyme is called the decreasing or wane of the moone, then
also hath she her hornes towarde the West, because the
Sunne is in the East, and this, vntill she turne agayne
in coniunction with the sunne, and then we see her not
lyghtened at all.

The bygnesse
of the moone.

The moone is lesse then the starnes, or other planettes,
except Mercurie, and lesse then the earth: and if anye shall
affirme the contrary, saying, that it is wrytten in the first
of Genesis, that God made two great lyghtes: the grea-
test, to gende lyght to the day, and the lesse, to lyghten the
nyght (as David also affirmeth:) To this I am sware,
that the moone being nearest vnto the earth, appeareth
vnto vs greater then she shold do, yf she were further dis-
taunce from vs. And although she be greate of lyght, (re-
leaved as we have sayde) and bygge of bodye, yet is she
not greate in respect of the other starnes, and therfore the
Wordes of Genesis aforesaid, maye be undersooode to
be spoken in suche manner and phrase as holye scripture
often useth, to humble and applye it seise to the weake-
nesse of our understandyng, and grossenesse of our senses.

The vi. Chapte, of the coniunctions and
oppositions of the sunne and the moone.

The

The seconde part.

Fol. xxx.



He Sunne and the Moone are moued vnder the Zodiacke, with divers motions. The motion
of the moone.

The moone with a swifter motion then the Sunne, foloweth hym, ouertaketh hym, and goeth before hym, vntyl she place her selfe Diametrallly opposite with hym. And

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when she hath thus ouertaken hym, so that they are both in one selfe same degree of the Zodiacke, then is the coniunction.

The coniunction.

When departing from hym, and beynge in equall degrees of the signes Diametrallly opposite, is the opposition. To knowe the tymes of these coniunctions and oppositions, is very profitable and necessary for Partners. These tymes maye be knownen in two manners. One way by the Ephemerides, or Almanackes, or other tables, or Lunary Instrumentes, and by these meanes is knownen precisely the day, houre, and minute of the coniunction and opposition. It may like lylye be knownen by the rules of computation, whiche are the rules whiche are knownen by aneropis, although not precisely, as by the booke aforesayde. And here is to be vnderstode, that from one coniunction to another, accordingyng to the mydde mouynges of the Sunne and the Moone, there passeth 29. dayes. 12. houres, and 44. minutes, and consequently from coniunction to opposition, and from opposition to coniunction, the halfe thereof, whiche is. 14. dayes. 18. houres, and 22. minutes. To knowe these coniunctions by rules of computation, is presupposed to knowe the golden number, and by it, the concurrent or Epact.

To knowe the tymes of oppositions.

734.3.14.43

734.3.14.43

The golden number, is the number of 19. yeres. In the golden number. In whiche tyme, the coniunctions of the Sunne & the Moone make all their varietys in the tyme of every yere. So that if the coniunction were the 12. day of Marche in this yere of 1545. from this yere in 19. yeres folowing, whiche shalbe in the yere of 1564. the coniunction shal returne to be at the 12. day of March. It was firste called the golden number by the Egyptians, who fynde found the use therof, & sent it to Rome writte in golden letters. To finde this number, it is needful to know his rootes, which is this:

The second part. T

The rootes of
the golden
number.

In the yeers that Christe our Lorde and redeemer was
borne (wherby we make this accounte) the golden num-
ber was the number of one, whitch was the yere of the
roote of beginnyng, and the fyfth yere of the byth of
Christe was two of the golden number. So that soynng
to the yeers of our Lorde, one of the roote of begynning,
and from all take away the 19, then the rest shalbe the
golden number, and ys you desyre to make computation
by a nearer roote, take for the roote, the yere of 1500,
when 19. was the golden number: and in the yere of 1501,
dyd begyn one of the golden number, and so consequent-
ly euer takyng away the 19.

This present yere of 1545. we haue .7 of the golden
number. And in the yere of 1546. we shall haue .8. &c.

The concurre-
nt.

The golden number beynge knownen, it is necessary for
this computation of the Moone, to knowe the concurrent.
The concurrent of every yere, is the number of the dayes
passed of the coniunction of the Moone at the beginnyng
of Marche. And these growe of the difference of the Solar
yere to the Lunar: as the Lunar yere hath 354. dayes,
and the Solar yere 365. so hauyng every yere .1. dayes,
of difference, whitch are added every yere, vntyll they
come to the number of .30. and passing .30. those that do
passee are of the concurrent.

The Solar &
Lunar yeres.

To fynde the
numbre of the
concurrent.

The number of the concurrent of every yere, is founde
in this maner. And the better to beare it in memorie, you muste imagine
thre places, and these commonlye are assigned on the
thambe, as the fyfth place at the roote of the thumbe,
the seconde in the myddle toynte thereof, and the thyrd
and last, in the top of the thumbe. Then in the fyfth place
put .10. in the seconde .20. and in the thyrd .30. Then by
the order of these places shalbe counted the golden
number: as one in the fyfth place, two in the seconde,
and three in the thyrd, returning four to the fyfth
place. &c. vntyll the golden number of that yere, for the
whiche the concurrent is sought. And the number of that
place where the golden number endeth, muste be soyned
with the number of the golden number; and that doth
amount

amount therof, shalbe the concurrent, so that it passe not 30. But if it passe 30. then that that is more then 30. is the concurrent of that yeere.

And here is to be noted, that the yeeres for this computation of the moone, beginne at the first day of March, and last vntyll the laste day of February, so that this present yere of 1545. by computation of the golden number, we haue seven: whiche accompted by the sayde places, endeth in the firste, whiche is 10. whiche also soyned with the golden number of seven, make 17. and so muche is the concurrent of this present yere.

Lyke wyse, this number of Epacte, or concurrent, is founde in multiplying the golden number by 11. and diuiding the summe by 30. then that remayneth, is the Epacte or concurrent.

The concurrent being thus knownen, then to knowe the dayes of the moone, it is necessarie to knowe three numbers. The firste, is the concurrent: The seconde, the number of the moneth in whiche you are, begynnyng at Marche: The thirde, the dayes past of the same moneth. And soyning these three numbers, ys they come not to 30. so many dayes old is the moone. And if they be 30. it is the coniunction. And if they passe 30. they also that passe, are the age of the moone.

This is vnderstoode in the monethes that haue 31. dayes, for in them that haue onely 30. dayes, the coniunction is at the 29. day, and they that passe of 29. are the age of the moone. As for example. The firste day of August, of the concurrent 17. Of monethes from Marche 6. and of dayes of the moneth 1. make 24. and so muche is the age of the moone.

An other example. The tenth of September, of concurrent 17. Of monethes, seuen: of dayes, ten, which are in all 34. And because that September hath onely 30. dayes, we must take away 29. of the 34. and so reale syue dayes, which are the age of the moone. And in lyke manner shal we come to February. 29. dayes of the moone.

It followeth, that the dayes of the moone being knownen, then vntreckonyng or disreckonyng backward,

Epacte.

To knowe the
dayes or age of
the moone.To knowe the
daye of the
coniunction.

The seconde part.

for example. The. xx. of July, the moone hath. xii. dayes taken from the. xx. Remayneth. viii. Then the syght day was the coniunction.

The daye of the coniunction is lykewyse knowne by fornyng the monethes (beginnyng in Marche) with the concurrent, & if they come not to. 30. then at so many dayes of that moneth as lacketh of. 30. shalbe the coniunction.

Example.

In August. 6. of the monethes, and. 17. of the concurrent, are. 23. whiche of. 30. lacketh 7. Then at the seventh day was the coniunction, and if they passe. 30. then taking them that passe, from the number of the dayes whiche the moneth had next before, and then that which remayneth, dooth shew the day of the coniunction. Lyke as the moone of September of the yere. 1546. we shal count the concurrent. 28. of monethes. 7. whiche are. 35. Then takynge awaye the. 5. from. 30. and one whiche August hath, remayneth 26. and so the. 26. of August, of the yere to come of 1546. the moone shal make coniunction.

The. vii. Chapter, of the declaration and vse of an instrumente, by the whiche is founde the place and declination of the Sunne, with the dayes and place of the Moone.



To knowe the
place of the
moone in the
zodiack, and
what aspectes
she hath with
the sunne.

In the seconde and thirde Chapter, I haue geuen rules to knowe the true place of the sunne, and his declination. In this Chapter I wyll describe an instrument, whereby maye be knowne the declination and place of the Sunne, and knowyng by the Chapter passe, the dayes of the

Moone, shal also be knowne her place in the Zodiacie, and howe muche of her is lyghtened, and what aspecte she hath with the Sunne. This instrument is in square forme,

sourme, and hath by the sides 23. degrees & a halfe, of the which the 23. & a halfe that descend from the midis downe-
ward, is the declination of the South signes: & the other
from the midis upward, are the declinations of the North
signes. Within this quadzature is described a circle, by
circumference whereof are the xii. signes & their degrees,
soyned to the circumference: and further within, is the
number of them, and then they: names. Yet further with-
in this, is another circle, where are the xii. monethes,
with their numbers and dayes.

The descrip-
tion of the in-
strument.

Then to the center of this circle are annered two run-
dels, whereof the greatest and lowest is called the rundel
of the Sunne. This hath an Index or shewer, in whiche
is paynted the Sunne, and in the circumference of it are
the dayes of the age of the Moone. In the other circle, in
the circumference thereof, is a rounde boale, representing
the Moone: directly from the whiche, is another Index
commynge soorth of the circumference of this rundel, in
whiche rundel are all the aspectes whiche the Moone ma-
keth with the Sunne.

Having descriyed the Instrument, let vs declare the
use thereof: whiche is this.

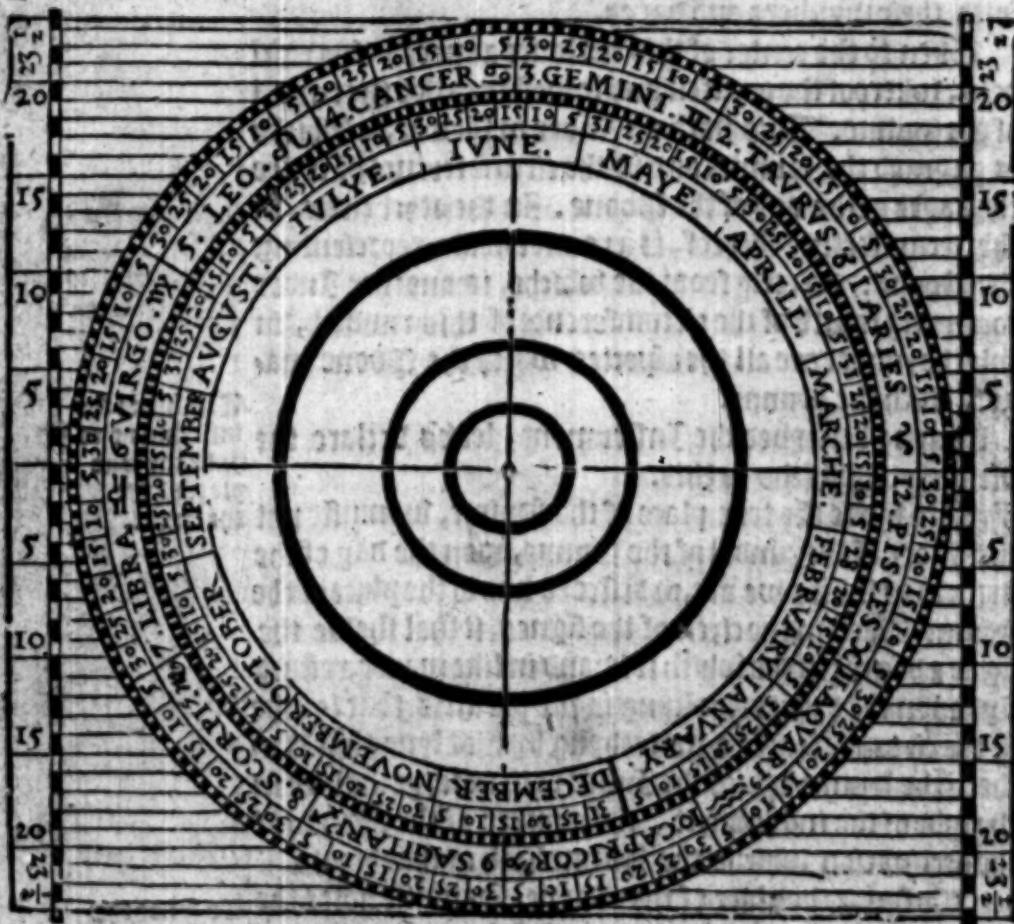
The use of the
instrument to
 finde the true
place of the
sunne.

Fyrst to synde the true place of the Sunne, we muste put the Index of the rundel of the Sunne, vpon the day of the moneth in which we are, or desire to know the place of the Sunne. Then in the circle of the signes, it shal shewe the signe & degree in the whiche it is: and in like maner, resting syly vpon the degree, looking in the paralels that touche in the circumference, & proceeding by that lyne that toucheth the Sunne whiche the Index doth note, ye shal see in the syde of the instrument, the number of the degrees of the declination whiche the Sunne hath at that day.

To synde the place of the Moone, we muste holde the Index of the rundel of the Sunne, fast vpon the daye of place of the moneth in the whiche we desyre to knowe the place moone.
of the Moone. And accountyng in the rundel of the Sunne, the dayes that haue passed from the daye of the coniunction(as I haue layde in the Chapter before) and
whiche endeth that number of the dayes, yf there
we

The seconde part.

We apply the Index of the Moone, it shall shewe in the circle of the signes, the place where she is. And so shall shee appeare in the instrument lyghtened or darkened more or lesse as in heauen. In lyke maner, consyderynge the place of the Sunne and the Moone, shalbe seene what aspect they haue, by the lynes that trauerse the superficiall of the Lunare circle or circle of the Moone.



The

The aspectes whiche the planettes hane one to another,
v; whereby they beholde one another, are syue,

Coniunction, is when two planettes be vnder one
selfe same degree and minute in the Zodiack, whose cha-
ract is this. Fine aspec-
tes of the pla-
nettes.

Opposition is, when betwene the place of the pla-
nettes is halfe a circle, whiche are 180, degrees, and is
thus figured. Opposition.

Trinall aspecte is, when betwene the planettes shall Trinall.
be fourt signes, whiche are 120, degrees, and is figured
thus. Trinall.

Quadrine aspecte is, when one planette is distaunte Quadrine.
from another by three signes, whiche are 90, degrees,
whose charact is this. Quadrine.

Sextile aspect is, when two signes are betwene them Sextile.
which are 60, degrees, and is marked thus. Sextile.

And yf by memorie you desyre to knowe the true place
of the Sunne, without respecte of the minutes (whiche
may suffisiently be done with the Albolabre) beare in me-
morie these numbers. 10. 9. 10. 11. 12. 13. 14. 13. 12. Of
the whiche, the syele serueth for Januarie, the seconde
for February, with theye signes: and so of the rest. Then
to knowe in what degree the Sunnetes, you shall take as
way the dayes that are applied to every moneth, accor-
ding to the sayde numbers of the dayes, for the whiche
you desyre to knowe the true place of the Sunne. And in
them that remayne, in so many degrees is the Sunne of
the signe into the whiche it entreth that moneth. And yf
the dayes past of the moneth, shalbe lesse then the dayes
applied to the same moneth: you shall sayne 30.
With those dayes paste of the moneth, and of the sunne
that amouith, you shal take away the dayes applied to
the sayde moneth, and the rest shalbe the degrees in whi-
ch the Sunne shalbe of the signe of the moneth past, as
for example.

Example.
The moneth of March pasteth 31 dayes, and the sunne
entreth into the signe of Aries the 21 dayes, and so
the 10 dayes remayne, and the sunne shalbe of the
signe of Aries 10 dayes, and so forth.

The second part.

Example.

January. 10 22
February. 9 X
Marche. 10 V
Apryll. 10 8
Maye. 11 II
June. 12 9
July. 13 8
August. 14 IV
September. 13 11
October. 14 III
November. 13 17
December. 12 5

The 22. of October, sayng away. 14. that wers applied, remayne. 8. degrees of **Scorpio**, where the sunne is. In other example. The 5. of December whiche are lesser then 12. whiche is applyed vnto it, yf we ioyne 6. to 3. which are the dayes of the moneth next afore, they make 35. and from them we take away the 12. tell 24. So in 24. degrees, is the Sunne, of the signe of the moneth before, whiche is **Sagittary**.

* The viii. Chapter, of the Eclipses of the Moone and the Sunne.



The Eclipses of the Sunne & of the Moone is a thyng that causeth great feare & admiration among the common & ignorant people, and to them that understande the cause therof, nothing at all. And therfore have I thought good to declare the effectes thereof.

The Eclipse of the Moone, is the interposition of the earth betwene her and the Sunne. And wher the Moone hath no proper lyght of her dwine, and the earth being darke and not transparent, maketh his shadow on the part opposite to the Sunne: the Moone by her proper motion doth passe by this shadow, and is Eclipsed or darkened either in the whole or in part, according to the portion of her that passeth by the shadowe. Moreouer (as we haue sayde) that only the Sunne is moued in the lyne Ecliptike, and the earth being in the center of the world, the point or prick of the shadow shalbe vnder the Ecliptike. The Moone declineth from the Ecliptik sometymes to the one part & sometimes to the other, because her eccentric wherinto she is moued, doth cut the ecliptike equally into two halves, so that the one halfe of the eccentric, doth decline fro the ecliptik toward the north part, & the other halfe

The mouynge
of the sunne in
the Eclipse.

halfe towarde the South, & the greatest declination of it from the ecliptike, is 5. degrees. In that maner, the moone shalbe at no time in y ecliptike, but only when she shalbe in eyther of the intersections where the eccentrikke doth cut y said ecliptike. That intersection where she passeth & goeth toward y North part, is called y head of the dragon, & is marked thus. ¶ The other where she passeth and declyneth to the Dragonward the South part, is called the tayle of the Dragon, and is marked thus. ¶ And the sunne shewing by his proper motion, & coming to y head, then shall the shadowe of the earth be in the tayle, because it is the poynct opposite. And yf then the moone come thither, of her proper motion she passeth by the shadow, & lacking lyght of the sunne, she is eclipsed. And if the sunne come to y tayle, the shadowe is in the head, and then shewlyll shall y moone be eclipsed, yf she passe by the head.

It is to understand, that the sunne is much bigger then the earth, and by perspective, the shadowe of the earth in howe much y further it parteth from it, becommeth sharper & sharper, until it come to a poynct: so that the shadow of the whole earth, is pyramidaly sharpe.

And as the moone is lesse then the earth, yet (although his shadow goeth sharpening) it suffiseth to eclipse the moone, yf she passe by the myddell thereof.



The secohde parte.

The eclipse of the sunne.

The Eclipse of þ sunne, is the interposition of the moone betweene vs & the sunne, as yf the sunne be in the fourth heauen, and the moone in the first, she being a dark body, and by her proper motion overtake the sunne, then puttynge her selfe betweene hym and vs, she couereth hym in parte, or in the whole, and this is the Eclipse of the sunne. As the sunne also goeth euer vnder the Ecliptike, at the tyme that he commeth to the head or tayle of the Dragon, þt then the moone make coniunction with him, shalbe the Eclipse of the sunne, soþ as muche as they are both vnder the Ecliptike.

The eclipse of the sunne is not universall.

The Eclipse of the sunne can not be universall in the whole earth, I say, vnto all them that maye see the sunne at the tyme of the Eclipse, as is the Eclipse of the moone universall. For yf the moone haue one parte Eclipsed, all that maye see her, shall see her eclipsed: But the sunne some maye see all wholly eclipsed, and other in parte, or other also not at al eclipsed: and this all at one selfe same tyme. The cause whereof, is the diversite of the aspects, whiche is to see the moone in the Zodiacke out of her place: as yf the sunne and moons shoulde make coniunction in the begynnyng of Aries, and in the head of the Dragon, they that then shoulde be in the Equinoctiall, vnder the sunne and the moone, or that the sunne and the moone shoulde be in they; Zenith, they shoulde see the moone hyde all the sunne.

Wiche þ sunne is eclipsed in the whole, or in parte.

And they that shoulde be in the North Climates, shoulde see, that the moone hydeth or dakeneth onely the South parte of the sunne, and not all. Agayne, they on the South parte, shoulde see the moone hyde the North parte of the sunne, and not all. And yf at the tyme of the coniunction, she haue a lytle passed the head of the Dragon, or lacke a lytle to come to the tayle, so that she be in the North latitude: they that then shoulde be in the North Climates, shoulde see the moone eclipse all the sunne: and they of the Equinoctiall shoulde see onely the North parte of the sunne eclipsed, and they of the South shoulde see hym nothing at all eclipsed. So that althougþ

although the Eclipse of the Sunne shalbe totall or particular, it can not be uniuersall in the whole earth.

Of the quantity of the Eclipse.

And note, that for the quantite of these Eclipses, the Astronomers diuide into viij. i. quall partes, aswell the Diameter of the Sunne, as of the Moone: and these partes they call syngers, punctes, or prickes, and accordingyng to the punctes of the Diameter of the moone, which is couerred by the shadowe of the earth, or the partes of the Diameter of the Sunne, which the moone doth couer, so many syngers or punctes shalbe sayde to be Eclipsed. As yf 6 the halfe, yf 3. a quarter, yf .4. a terce, or thyrdre parte, yf .9. three quarters, yf 8. two terces.

It is also to be noted, that although the sunne be bygger then the Moone, yet at some tyme the moone seemeth greater then the Sunne. And this shalbe when the Sunne is in the Auge of the Eccentrike, & the moone in the opposite of the Auge of the Epicicle. And when it so appeareth, he may be all Eclipsed. Sometyme also the moone seemeth lesse. This is when the Sunne is in the opposite of the Auge of the Eccentrike, and the moone in the Auge of the Epicicle. Then although we should see the center of the moone in the center of the Sunne, she can not hyde hym all wholly, because the Sunne shall appear greater.

Of this that we haue sayde, it followeth that all the Eclipses of the Sunne, muste of necessitie be in the coniunction. And the Eclipses of the moone, in the opposition: whereby is inserred, that the Eclipse of the Sunne in

why the Moone seemeth sometyme bygger, and sometyme lesse then the Sunne.



The Sunne is Eclipsed in coniunction, and the moone in opposition.

The second part.

The eclipse of
the sunne in
the death of
Christ.

Howe to see
the eclipses.

the death of Christe our redremir, was not naturall, but miraculouſe: forasmuche as then was xv. dayes of the moone, at whiche tyme the moone is at the full, and farre diſtant from the Sunne, and coulde not Eclipse hym. In lyke maner is to be noted, that to ſee the Eclipses, they of the Sunne muſt be in the day, and they of the moone in the nyght. And whether the coniunction be in the nyght, or the opposition in the day, the Aſtronomers make none account.

Mouyng in
tyme.

what is tyme.

Howe tyme is
cauſed of gene-
ration & cor-
ruption.

The begin-
ning and en-
ding of tyme.

The place of
tyme.



Orasmuche as bytherto we haue en- treated of the mouinges of the Sunne and of the Moone, and howe all mouyng is in tyme (for that nothing may be moued in an instant or out of time) It ſhalbe conuenient nowe to declare what thyng Tyme is, and into what partes it is diuided.

Tyme (as sayth the philosopher) is a measure of mouyng, accordanſe to fyſte and laſt, or before and after. Althougb by accident (as Armandus hath ſubtilly defined) Tyme may be a measure of telle or quyckneſſe: as meaſures of habites are meaſures of priuations. Or Tyme may be a measure of the mouyng of the fyſte mouable called Primum mobile, and cauſe of generation thereby, and of corruption by accident. Tyme hath the lymittes that hath the worlde, and as the worlde, ſo is it cauſed of the mouyng of the heauens, and beganne when G O D created the heauens, and ſhall ende when the worlde ſhall haue an ende, as the holy Scholes of the Diuines teache vs. It is aſſigned to be within the heauens, forasmuche as without them, is neyther tyme, nor any naturall place. All the tyme ſince G O D created the worlde, bntyl it ſhall haue an ende, is called Seculum (that is) a world, or an age of Tyme. Albeit this worlde

Seculum

Seculum in an other sense, may be extended further then the durabilitie or continuance of the worlde, and this in holy scripture is called seculum seculi, that is, the world of the world: or, secula seculorum, whiche is as much to weane, as the worlde, and worldes to come, whiche signifieth eternitie, or everlasting worlde without ende. Lykewise also, seculum is taken for the space of a hundred yeeres, whereby in olde tyme certayne playes were called seculares, because they were celebreate from a hundred, to a hundred yeeres. The Pope Paule, the third of that name, commaunded them to be celebreate in Rome, in the yeere of 1535. whiche was the yeere in the whiche the seculum ended, and beganne a newe seculum.

And as in tyme are dyuers moouynges, so hath it dyuers measures, whereof some are greater, and other lesse. The greatest measure of tyme, is a revolution of the heavens, which is slowly mooued, and the p̄ncipal or cheife of these, is that that the sunne maketh, whiche we call, a yeere. The lesse measure, is the moouing of the first mouable, whiche moueth most swifly, and this measure we call a day. And for as muche as thers is variation in the greatest measures, we wyl in the Chapter folowing, in treate of the yeere, and of the diversitie thereof.

The x. Chapter, of the yeere, and of
the divers beginninges and reckonynges.
or computation had thereof in
olde tyme.

Here are three differences of the yere, as the great yere called (Annum magnum) the solar yere, and the Lunar yere. The greate yere is the space of tyme, in the whiche al the planettes yere, returne to the place where they had ben sometime before. As if they al had benne in the begynnyng of Aries, and had begunne their course from thence, and shoulde agayne all returne thither: then shoulde be the greate yere.

The seconde parte.

The revolu-
tion of the
eighth sphere.

The solar
yeare.

Moore the
Egyptians
paynted the
yeare.

The quanttie
of the yeare

The yeare of
the Hebrews
The greces.

Julius Cea-
sar

Leape yeare.

Dayes of the
yeare.

By the description of other, the greate yeare is when the ryght sphere soyntly with all the auges, make one perfecte revolution at the moonyng of the mynthe sphere. And this shalbe in the space of. xlii. thousande yeeres.

The solar yeare, is a revolution of the sunne, caried by the proper mouing of his heauen, vpon the aris and poles of the Zodiack, endyng where it beganne, and returning an other yeare by the selfe same course, as the Poet Virgil affirmeth, saying.

Atque in se sua per vestigia voluitur animus.

That is to say, The yeare turneth againe to hym selfe by his owne proper steppes.

The Egyptians lacking the use of letters, and hauing the same conyversation, paynted the yeare lyke vnto an Adder, bytyng her ownetayle: and hereof was a ryng called Annulus, as it were, Annus, (that is a yeare) because a ryng turneth rounde in it selfe as dooth the yeare. Of the quanttie of this yeare were divers opinions and compukations among them of auncient tyme. The Arabians & Persians accompted it regularly by xii. moones, whiche are 354. dayes. Romulus gaue to his yeare x. monethes, because that tyme suffised to a woman to bryng foorth her byth, and also for that duryng so muche tyme, it was not lawfus for a wydowe to marrie after the death of her husbande. Junna Pompilius added two monethes, to make it vp twelue monethes in. 350. dayes, whiche was the moste auncient yeare of the Hebrews, according to the whiche, they accompt at this day. The Greces and Egyptians conydering the course of the sunne, made the yeare of 365. dayes: Then by the commaundement of Julius Caesar, (whose order we no we obserue) were added .25. houres, to the ende to make equall this number of dayes with the course of the sunne: and hereof, the bisettile or leape yeare hadde his begynnyng, from fourre to fourre yeeres. But to say the truthe, they erred: The one, by somewhat to much, and the other, by somewhat to lytle.

The yeare conteyneth 365. dayes. 5. houres, and 49. minutes.

Lyke.

Lykelys, at the firsfe, the peere hadde viflers begynnynges, summa Pomplius begannie it from the Wynter Solstitiait, because that then the sume begynnieth to rysse towarde vs, as Duide affirmeth in these verses,

Beginning of the page.

Out.

Bruma noui prima est, veterisque nouissima Solis;
Principium capiunt Phebus & Annus idem.

Brama is
the stay of the
Sonne in
Wynter, the
wynter solsti-
tiall, and shor-
test day of the
yeare.

which may thus be Englished.

W^mme is the first of the newe yere,

And last day of the olde:

The summe and yeere begynne at once,

As Duke bath vs tolde.

Romulus began it in Marche, at the Equinoxtiall of the spryng, because that then all thynges reuise and florisse: and by the opinion of the Diuines, it seemeth good reason to begynne the yere at Marche, because the worlde was created the 25. of the kalendes of Aprill, whiche is the 15. of the moneth aforesayde. Lyke wyse, God speakyng of this moneth to the people of Israel, sayde vnto them, This shalbe the firsste of the monethes of the yere. The Arabians begynne from the Sommer solsticiale, whose opinion is, that the sunne was made in the signe of Leo. Other begynne the yere in September, about the Equinoxtiall of Autumne, as doo the Jewes, reaslyng in the auctoritie of Genesis, where is wrytten thus: Let the earth bryng forth greene herbes, to have fruste agreeable to theyz kynde. And because Autumne is a fruitfull tyme, they began from thence to accompt their yere. The Greces, Persians, and Egyptians, accompted it from October. The Christians, sonie from the incarnation of Christe: other, from his bryth, and other, from the firsste day of Januarie.

The creation
of the world.
Exodus. vii.

In lyke manner, is greate diversitie in begynnyng the
number of yeeres, whiche we call Era, that is, the date. Wurthe in
the number of
yeeres, of the
date.
The Grekes beganne theyr date from the death of
greate Alexander. The Egyptians, from the death of
Sabin.

Qabq

The second part.

Machomet. Sabuchodonosor: the Persians, from Cesdargist: the Arabians or Mooses, from the preaching of Machomet, who was after the birth of Christ. 626. yeeres: Other also, from the Romane Imperours. The Christians beganne the Christians the accompte of our Sauour Iesu Christ. 500. yeeres after his birth, as wryteth Cardinall Cusanus, and here it shall not be from my purpose, to shewe howe fullie and rightfullie was comauanded by Don John king of Spaine, the firsse of that name, that in the courtes and parlementes whiche he helde in Segouia, in the yeere of 1383. leauiyng the dates that they had begunne from the Imperour Octawan, for tributes and other paymentes specified in wrytings and privileges, they shoulde no more put the date of the Imperour, for as muche as the day in the whiche the sonne of God became man, and was borne of the blessed Virgin, was so excellente a thynge, and moste worthy to be had in memorie. So that in Spayne, since that time, in al common wrytinges, the date is made from the Nativite of our Lorde, beginnyng there the firsst day of the yeere, & commonly the firsst day of Januari, some Astronomers beginne it the firsst of Marche.

We haue in this Chapter intreated of the great yeere, and of the Solar yeere, with his quantitie, beginnyng, and date. In the Chapter folowing, we wyl entreat of the Lunar yeere, whiche we cal a moneth.

The xi. Chapter, of the moneth, and of his differences.

The Lunar
yeere or mo-
neth.

Revolution of
the moone.



Onsyderyng the moneth absolutely, without hanyng respects to the Solar yeere, it maye be called a yeere, according to the division we haue made in the Chapter of the yeere. For it is a revolution of the heauen of the moone, whiche moueth slowly in comparison to the firsse heauen. And y-

We consyder the moneth as part of the yere, then is the name of a moneth more proper unto it. For this word Mens mensis in Latin, is derived of Mensura, which signifieth measure. And so the moneth and yere referred to tyme, all may be called moneth: soasmuch as all is the measure of tyme, as we haue touched in the sayde Chapter of the yere.

The moneth is to be consydered in two maners: either as it is parte of the Solar yere, or is caused by the course of the Moone. The moneth that is parte of the Solar yere, is that whiche at this day we use. And into

The division
of the yere
into xii. moneths.

xiij. of these monethes, is the yere diuided: as January, February, March, Apryll, May, June, July, Augull, Septembre, October, Novenber, December. They are not all of equall dayes, Apryll, June, Septembre, and Novenber, haue 30. dayes: all the other haue 31. except February, which hath 28. and when the bisettile, or leape is, it hath 29. The names and numbers of these monethes were assigned at the wyl and pleasure of men, and the cause why they haue remayned so long tyme, is the auctorite of the Emperours, that ordeyned them for the common people, who accepted them by the Romane Church which admitted the use of them.

The Lunar moneth hath two consyderations. The one is the tyme which the Moone tarþeth from that she moneth.

commeth forth from one punct of the Zodiack, vntill she returne thyþer by her proper mouyng. And this is called

The moneth
of peragration.

the moneth of peragration: in which revolution she spendeth 27. dayes, and almost 8 hours. The other

consyderation is, haþyng respect to the tyme whiche the moone tarþeth, from that she is in coniunction with the Sunne, vntill an other coniunction. And this is called

The moneth
of consecration.

the moneth of consecration; by two dayes 4. hours 44. minutes. For the Sunne and the moone beynge in coniunction vnder one punct of the Zodiacke, and mouyng both by theyþ proper mouynges towarde the East, as the mouyng of the moone is swifter then the mouyng of the Sunne, she leaueth hym behynde.

The mouyng
of the Sunne
and Moone in
coniunction.

And

The second part.

And when she bath ended her moneth of yeragation,
She returneth to the poynt from whence she departed:
and not syndynge the Sunne there (because in the meane
tyme the Sonne of his proper motion hath gone almosse
27. degrees) the Moone passeth from this poynt: and in
the sayde 2. dayes .4. houres .44. minutes, overtaketh
the Sunne: and so commonly bath this moneth of conse-
cution, 29. dayes .12. houres and .44. minutes.

So that what soever is sayde of the Lunar moneth, is to be vnderstode of this moneth of consecution, whiche all they vse that account by Moones: as do the Hebrews, Arabians, and Persians.

To know the
tides by the
aspects of
the Moon.

The illumination of the change of the Moone.

Interlunium, more, and sometyme lesse. When the coniunction shalbe
is the space of from the begynnyng of Capricorne vntyl the ende of Ge-
yng in the minis, and the Moone bath North latitude, and her mo-
which neither uing swyft: then shal the newe moone soone be seene, and
the old Moone both appare, so shall the Interlunium be but lytle. And when the con-
nor the newe function shalbe from the begynnyng of Cancer, vntyl the
Moone is ende of Sagittarius, and the moone bath South latitude,
seen, and her mouyng slowe: the longer wylle it be of the newe
moone shewe her selfe to vs. And certayne of
these causes concurring and not all, so

Shall the interlunium be in a
meane betwene both.

The

The xii. Chapter, of the weeke.



THE weeke is a tyme of seven dayes, the begynnyng wherof, is sunday, and so do the Jewes counte they: firste day, saying, *Prima sabati, Secunda sabati,* (that is) the firste of the sabbath, the seconde of the sabbath, &c. to the syrth of the Sabbath, and then y sabbath. *The Romanes* that called the planettes, Gods, for as much as the sunne was principal among them, called their first day, y day of the sunne, the seconde, of the moone, the thirde, of Mars, the fourth, of Mercury, the fift, of Jupiter, the syrth, of *Ypans*, Venus, the seveth, of Saturne. *The Christians* solennising the sunday, beganne they: accompte from it: as, on such a day our Lorde was born: or such a day he rose: and on such a day he sent the holy ghost vpon his apostles, &c. They also accompt the dayes of the weeke for *Festia*.

The xiii. Chapter, of the day, and of the nyght.



THE day is of two sortes, as, the natural day, and the artificial day. *The natural day.* The natural day is the space of tyme, wherin the sunne is caried by y firste moouable about the earth, from the Meridian to the Meridian, & from the Meridian under the earth, comming to the Call, and from thence returnyng agayne to the saide Meridian: and this tyme hath the Equinoctiall greate one whole tyme, & more, suche parte of it as correspondeth to the proper moouing of the sunne: or other wyse, the natural day is a circle described with the center of the sunne, at the moouing of the first moouable. *The beginnyng of the natural day.* The Romanes beganne this natural day, from mydnyght, and ended it in the mydnyght following, and so doo we accompte it for fasshyng dayes: and

*Festive, signis
fether vacant
dayes, or som
tyme holy or
festival dayes.*

The seconde part.

and from evenyng to evenyng, in celebrating of sessuall dayes. The Athenienses beganne it at the sunne set, or goyng downe of the sunne. The Babylonians, at the ryng of the sunne. The Umbrians, and Ethuscos, from the mgydday, or noone, and ended it the noone day following. In this manner doo the Astronomers begynne it, and find that the day shall ener begynne at one selfe same houre for the equalitie of the meridians. And if they had begunne it from the ryng or fall of the sunne, it shoulde not be cuer at one selfe same houre, because the sunne ryseth and falleth at sometymes sooner, and at other tyme s latter: and so shoulde the beginning of the day be variable. And it is to vnderstande, that when we commonly say, at the tenth day of such a moneth: the same tenth day dooth ende the same day at noone, and the houres that runne from that noonetyde forewarde, are of the eleventh day: and so doo the Astronomers accompt them.

The ende of natural day.

The artificial day.

The nyght.

The day artificial, is part of the day naturall, & is the time that the sunne targeth from that it riseth in the East, vntil it fal in the West. And the nyght is that part that lacketh or sayleth for the naturall day, whiche is the tyme that the sunne targeth from that he hideth hym selfe in the West, vntil he returne to appearre in the East: and so the day artificiall and the nyght, make one naturall day. And accordingyng hereunto, it is wrytten in Genesis, that of evenyng and morning was made one day. Isodorus defining this artificiall day, sayth, that the day is the presence of the sunne, or the beynge of the sunne aboue the earth: as it is nyght vnto us when he is vnder it. O; otherwyse, the nyght is the shadowe of the earth, extended diametrallly opposite to the sunne. The quantitie and differences of these dayes artificiall, and they: nightes, and howe they increase and diminishe, we haue largely declared in the first Chapter.

The

The xliii Chapter, of hours.



There is two differences of the daye, as the naturall daye, and artificiall: so is there two differences of houres, as houres naturall whiche corresponde to the naturall daye, and houres artificiall, whiche correspont to the artificiall daye. *Hora* or *Ora* is a Greeke name, and signifieth ende. And so saye we *Ora maris*, for the ende or brymme of the sea, or the lyte or edge of apparel, as sayth Isodore in his *Etymologies*. The houre naturall or equall, is a 24. part of the day naturall: and is the tyme of passing 15. degrees of the Equinoctial. These 24. houres that make one natural day, the Astronomers doth begin the day at the Meridian, compting the houres after the order of the sytle inouenible, whiche is from the sayde Meridian, proceeding towarde the West, and from them to the Meridian in the angle of mydnyght, where they accompt 12. houres, and from thence toward the East, and come to ende the 24. houres in y same Meridian where they began: this they use for the computation of the tables of the mouynges of the heauens. The Astronomers use the same in theyz instrumentes, as in the Astrolabie, and Dyalles Horizontall and verticall, and in all other instrumentes for houres. In Spaine also we use to accompt these 24. in two tymes twelue, begynnyng at noone, and endyng xiiij at mydnyght: and agayne, begynnyng at mydnyght, and endyng other twelue at noone. And to distincke the one from the other, they call the one after noone houres, and the other forenoone houres: and commonly we saye syre houres of the mornynge, and syre of the evenynge. In Italy they accompt them from the falling of the Sunne, vntill the next fall the day following.

The artificiall or temporall houre, is a twelveth part of the day arcke by the myght arcke.

houres naturall and artificiall.

The houres naturall or equall

15. degrees
12. hours
12. hours
12. hours

12. hours
12. hours
12. hours
12. hours

The hours
artificiall or
temporal.

They

They are called temperall houres, because they varye in the tyme that the day varyeth. For in the tyme that the dayes shalbe great, so shalbe the houres. And when the dayes shalbe shorte, so lykewyse shall the houres be, and in lyke manner of the nyghtes. So that, as the artificiell day great or lyttle, is diuided into other 12. houres, even so the nyght great or litle, is diuided into other 12. The auncientes diuided the daye into fourte partes, and the nyght into other fourte, geuyng vnto every quarter part three houres. At the ryng of the Sunne, whiche was the syngle houre of the syngle quarter, they called the syngle houre; and three houres passed, they called the thyrd houre, and syre houres passed of the daye, they called the syxt houre, whiche was the mydday or noone tyde. Also the mynthe houre, they named at nyne houres past of the day. And the Sunne sette, or goyng downe of the Sunne, they called the Cuening: as sayth the Poet Virgill in this bourse.

Interpretation of certayne places of the Gospel.

The nyght diuided into fourte quarters.

Fourte watches of the nyght.

Ante diem clause component vesper Olimpo. And accordingyng to this computation, is to be vnderstoode that wryteth Saint Mathew: That the labourers came to the Vinearde at the eleventh houre, wherby is meant the fist houre, one houre before the Sunne was set. And when we reade in Saint John: The agne leste hym the eleventh houre, &c. By this accountt shalbe one houre after noone, when Christ healed the sonne of the Keifer that was diseased in Capernam. In lyke manner by these houres the auncientes diuided the nyght into fourte quarters, geuyng three houres to every quarter. And in these fourte partes of the nyght were souldiers appoynted to watche. In the syngle quarter whiche they call Caniculum (and we the syngle sleepe) they watched all. In the seconde, whiche they called Intempestum, beynge the tyme of mydnyght, the young men watched. In the third, whiche they called Gallinum, of the crowyng of the Cockes, watched the souldiers of myddle age. In the fourth & last quarter, called Matutinum or Antilocanum (that is, the spring of the day) the olde souldiers watched. And thus is vnderstoode the syngle, the seconde, and thyrd watche.

watche of the nyght. In lyke maner ought the mariners to keepe watche and warde, to auoyde aswell the peryll Howe mariners ought to
watche. of the sea, as also the daungers of Rovers: and to di-
vide the nyght by quarters after the maner of soldiers,
as dyd also the mariners in olde tyme.

¶ The xv. Chapter, of the makynge and vse of a
universall Dgall for the day.



Here as in the Chapter before, we have entreated of houres and they³ differences, we entendē here to de-
scribe the makynge of an instrument
generall, to knowe the houres of the
day by the beames of the sunne: whi-
che is donne in this manner. Take a
round plate of laton, and let it be cal-
led the Equinoctiall circle: the circumference wherof, you
shall diuide into .24. equall partes by both the sydes, and
from the center to every of these partes, you shall drawe
a ryght lyne: one of the whiche, halbe a Peridian. And
in the one part of that, wryte .ri. whiche shalbe the houre
of the mydday or noone. And in the other parte, wryte
other .ri. whiche shalbe for mydnyght. In the byggest
part, turning upon the center, towarde the ryght hande,
wryte, one, two, thre, four, &c. In the lower, or neather
part, you shall count towarde the left hande, turning
uppon the center: so that the one houre of the one part,
come uppon the lyne of the one houre of the other part,
in lyke maner two uppon two, three uppon three, and so
forth of the other. And note that in the lyne of sixe at al-
ter noone, and at the lyne of sixe in the morynge, there re-
mayne certayne round peeces, corners, or endes, after the
maner of axis, of the thickenesse of the selfe same plate.
Then make a halfe circle of the same metall as bygge as
the halfe circumference of the plate, and of the thicke-
nesse of a peice of .iiii. ryals of plate, or somewhat more,
even as the plate it selfe, and of the breadth of halfe a

To know the
houres of the
day by the
sunne.

The second part.

synger if the instrument shalbe great, or lesse if the instrument shalbe lesse. This halfe circle, shall you graduate or diuide into .180. degrees, begynnyng at the one ende, one, two, three, and so soorth unto .90. in the mydest, and the lyke shall you doo from the other ende unto the same. .90. Also you muste number them in the breadth of the same halfe cyrcle: and this halfe circle, shall you make fast on the neather part of the instrument, so that the endes thereof may be fyred in the endes of the Meridian lyne. Then throngh the center of the plate or Equinoctiall circle, shall passe a round Steele or wryte of the same metall, made faste or sothered in it, so that it ryse and come soorth equally from every syde of the plate the fourth parte of the Diameter of the same, and this shalbe called the Axis or axillree of the worlde. The instrument beyng thus made, you shal place it or set it in a frame, hauyng two armes, standarde, or arches, so that it change betwene the sayde arches, bothe vp by the rounde peers or endes of the plate leest thereof at the endes of the lyne of the syre houres aforesayde, in suchesort, that beyng thus stayed, it may be directly turned. And in the mydest betwene these two armes, beneath in the foote of them, or where they are placed, you shall reyse a prycke, or poynt: so that the plate whiche signifieth the Equinoctiall, beyng perpendicular, the bygynne or edge thereof may fall vpon the poynt or prycke, and consequently the plate standyng playne or flat, the .90. degrees of the halfe circle, must shewe or touche the sayde prycke, as shall also the ende or extremitie of the Axis of the worlde, and the other ende shall shewe the Zenith or vertiall poynt.

The placing of the instrument. This instrument muste be so placed, that the Meridian lyne be North and South: whiche you shall synde in this maner. In an open and playne place where the Sunne shyneth for the moste part of the daye, you shall make a circle with a payre of compasses, in the myddell whereof, you shall set a steele or wryte, so byrght that it declyne not or bende not, ryther one way or an other, and the same no longer then the fourth parte of the Diameter of the circle. Then in the morwyng when the Sunne riseth, the

The syndyng of the meridian lyne. shadows

Shadowe shalbe very long , and as it ryseth bygher and bygher, so the shadowe doareth shorther and shorther. Then muse you obserue the tyme when the extremite or end of the shadowe toucheth in the circumference of the circle, and where it toucheth, you shall make a prick: Then goeth the shadowe shorthering unto the midday or noone tide, and as from thence the sunne declineth , so dooth the shadowe encrease, and when it shall comme agayne to the circumference of the circle, you shall make an other prick: Then shall you parte in the myddest , the arke that is betweene the one prick and the other, and from the myddle prick, drawe a ryght lyne to the center of the circle: And that shalbe the Meridian lyne, wherenpon you shal set the instrument. Furthermore, in the soote of the frame of the instrument, you shal set a compasse or dyall, which shal shewe the Meridian lyne. This donne, vpon the arches of the frame, and corners of the sre houres, you shal turne the Equinoctiall so farre , that it passe so muche of the halfe cicle by the middle prick, how many degrees the pole is rased above the Horizon of that Region or place where you are , and then the shadowe of the wyr or strole, shall fuly shewe in the plate, the houre, and what a clocke it is.

The elevation
of the pole.

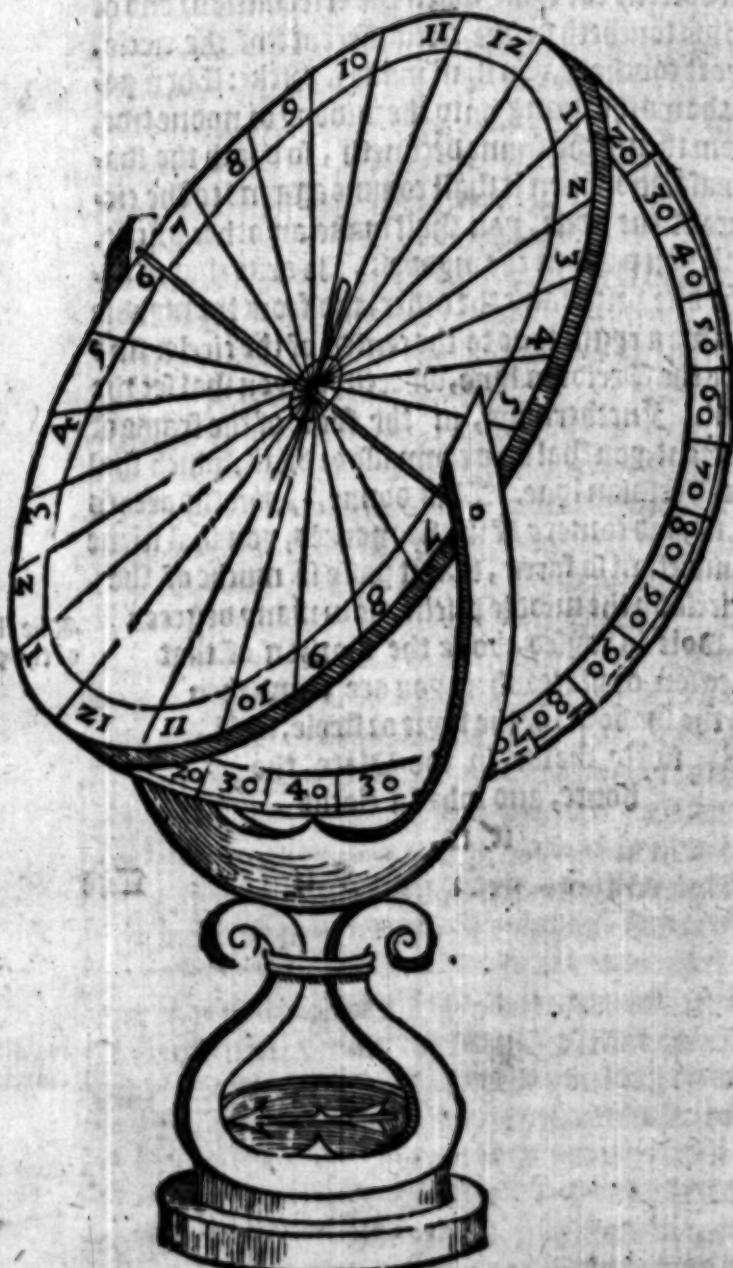
F 11.

The



The seconde parte.

Chere followeth the figure of the
Instrument.



¶ The.xvi. Chapter , of certayne particuler
Dyals, Murrall, and Horizontall.



Among sundry maners and fashions of particular Dyals, there are two principall. Wherof the one is Horizontall, whiche is placed in the superficiale of the Horizon, the other is vertical, and must be made or set on a walle perpendicular, and directly agaynst the south or myddaye, from the poynt of the true leuant or East, to the true ponent or West, the whiche the Mariners call East and west. To make any of these East and west two Dyals, you must drawe a ryght lyne, and call it the Aris of the poles of the worlde, vpon the whiche you shall drawe an halfe circle, and diuidest in 90. equall parts. And where the halfe circle is cut with the lyne of the Aris, muste be accounted by the circumference, the altitude of the pole for the citie or place for the whiche you intende to make the Dyall. And in the poynt of the circumference where endeth the altitude of the pole, you shall make a marke, and mynte there, The altitude of the pole. And from that poynt drawe a ryght lyne unto the poynt whersyon beganne to account the altitude of the pole, whiche lyne shalbe called the Demidiameter, or halfe Diameter of the verticall circle. And from the same poynt of the altitude of the pole, drawe another ryght lyne to the other extremite or ende of the Aris, and this shalbe called the Demidiameter of the Horizon, and lykewyse from the same poynt of the altitude of the pole, drawe a ryght lyne perpendicular vntyl it touche in the Aris, and this shalbe called the Demidiameter of the Equinoctiall. Hereby is consydered a Triangle whiche hath by the sydes thereof, the Demidiameter of the vertical, the Demidiameter of the Horizon, and the aris of the worlde, The triangle. Whiche Triangle shalserve afterwarde. These three Demidiameters, of the vertical, the Equinoctiall, and the Horizon, being founde, you shall make the Dyall in this maner.

Dyals Murrall
horizontal and
vertical.

The seconde parte.

The makynge of the Dpall. Drawe a ryght lyne, somewhat long, & cal it the lyne of contingence. This shal you cut with an other line in right angles, after the maner of a crosse, which shalbe the Meridian lyne. Then with your compasse, take from the triangle the Hemidiameter of the Equinoctial, and of this bygnesse, drawe a circle vpon the meridian lyne: so that the edge or brymme of the circle, touche in the lyne of contingence. Then with a compasse, take the Diameter of the verticall circle, ys you wyll make a murall Dpall, or the Hemidiameter of the Horizon, ys you wyll make a Horizontal Dial, on a playne or flat forme. Therfore with such Hemidiameter as you desyre, you shal drawe a circle vpon the other part of the meridian lyne, so that the circumference thereof touche in the lyne of contingence. Then shal you diuide the Equinoctial circle into four equal partes, and the quarter that is towarde the lyne of contingence, shal you diuide into sixe equal partes. And setting the end of the ruler in the center of the Equinoctial, and vpon euer y poynct of them that diuides the syre equal partes, from thence shal you drawe certayne ryght lynes, vntyl they touche in the lyne of contingence. And from these poynctes of the lyne of contingence, you shal drawe other ryght lynes, to the center of the Horizontall circle, whiche lynes shalbe the determiners of the houres. And neare vnto the meridian lyne, where it toucheth in the lyne of contingence, you shall wyte .ii. and consequently towarde the East, you shall wyte, one, two, three, four, five, syre, and from this syxth houre, you shall drawe a ryght lyne, whiche shall passe by the center of the Horizontall circle, equallly distaunt from the lyne of contingence. The one quarter of the Horizontal being drawen by the selfe same, and of the same measure and bygnesse shal you drawe the other, in such sorte, that the same bygnesse that is from twelve, to one, the selfe same shal you geue from the twelvth, to the eleventh: and the same bygnesse and measure that is from one, to two, shal you geue from .xi. to .xii, and so foorth of the other.

And note that the Horizontall Dpall, after the syxth houre of the evenyng, shal haue the houres of .vi. and .vii, and

and in climates farr North, or also, and more yf houres of the
neede shall requyre: and consequently muste haue the hou-
res of ffe and fourre of the morning, and in climates farr
North, thre also: and these must be so marked, that from
fve to seuen, may be the same that is from ffe to ffe, and
from seuen, to eyght, the same that is from fourre to ffe:
also, fourre and ffe of the morryng, as seuen and eyght.
The dyall being thus drawen in paper, or on a table, or
any other thyng, must be paynted (on a table, or in ston, *Placing of*
or in what so ever you desyre to make the Dyall) a circle the dyall.
of the same bignesse, as is the circle horizontall, and in
that must be translated the lines and numbers of the said
circle horizontall: Then must you make a tryangle of me-
tall, of the selfe same bignesse and fourme that is made in
the myddis circle: and the side of this triangle (whiche is
called the halfe diameter of the horizon) must be fird vpon
the meridian lyne of the horizontall Dyall, so that the side
of the tryangle (whiche is the aris of the worlde) and ex-
tremite or ende thereof, may fall in the center of the ho-
izontall Dyall, and muste stande so perpendicular, that it
declyne neyther to the one parte, nor to the other. The
Dyall beyng thus made, you shal set it vpon a meridian
lyne, so that the meridian lyne of the Dyall may stand
or reast vpon it, and so shal the shadowe of the trian-
gle shew the houre: and if for this place we desyre
to know it, we must fire it there. And if for any
other place, so setting it we shall haue a cer-
tayne houre. So may we in an instant
remoue it to an other place, and like-
lywise set it there, to make cer-
tayne and true demonstra-
tion of the houre.

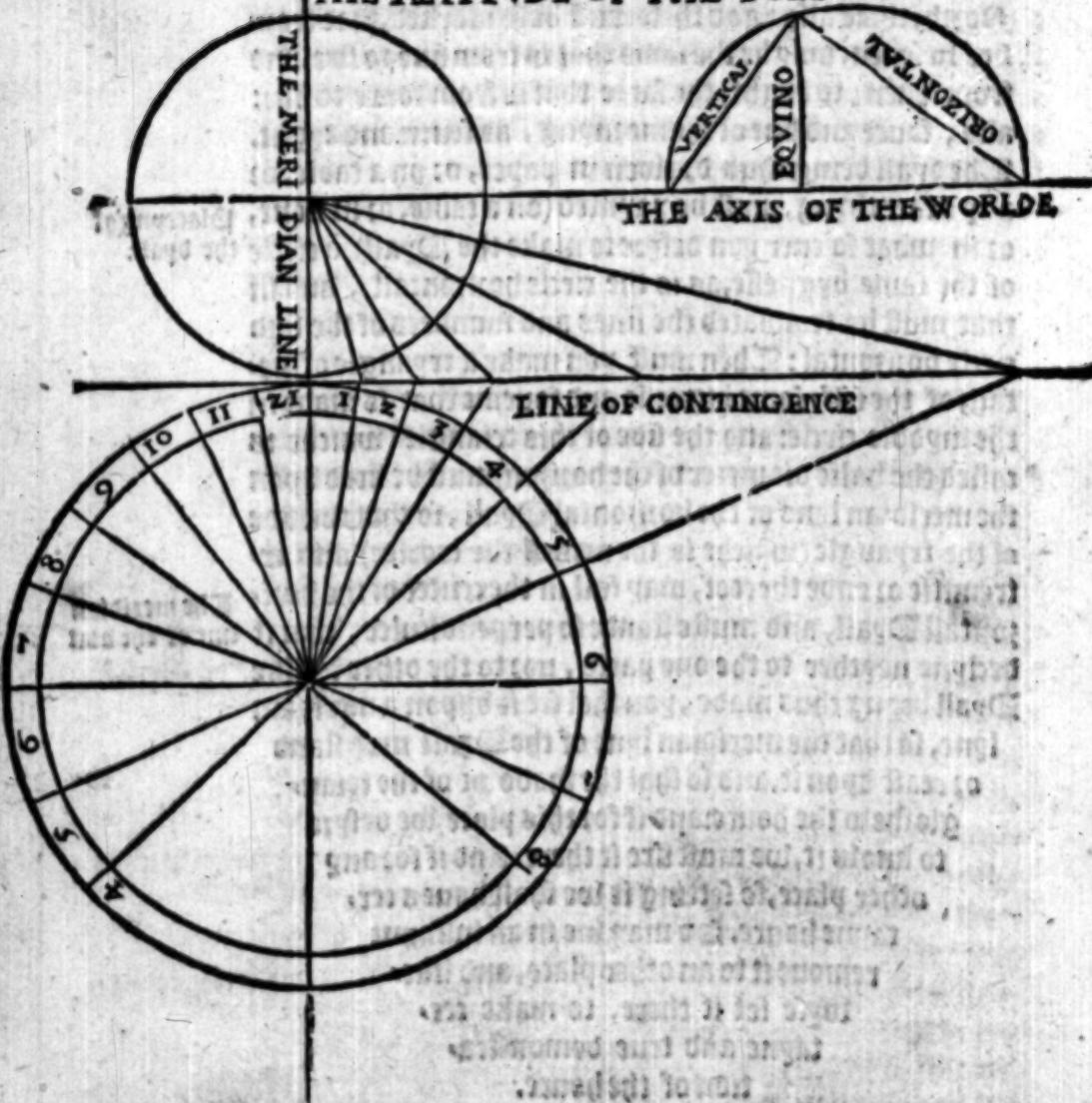
The meridian
line of the dial

F ffe *D*ars

The second part,

Here foloweth the figure of this demonstration.

THE ALTITUDE OF THE POLE 377



The making
of the vertical
Dyall.

In lyke manner, as is made the Horizontal Dyall,
must be made the verticall, takynge from the triangle the
Hemidiameter of the circle verticall.

And note, that for the circle verticall, it shall not be
needful of more then syre houres before noone, and other
syre

syre after noone. And the triangle muste be set in the Meridian lyne, vppon the side that is called the Demidiameter of the circle verticall, and if you wyl not make a triangle of metall, but that a wyre of Iron maye geue the shadowe, then wyl you make the sayde triangle of paste or paper, and accordyng to the forme or paterne thereof, make the wyre of iron, and cause the same to be set in all sortes of Diales, as is before sayde.

The xvii. Chapter, of the composition
and use of an instrument generall for
the hours of the nyght.



Here as in the Chapters past, I have
described the manner and forme, to
make two Diales for the hours of
the day, me seemeth that for the more
perfection of this woork, it shold be
conuenient here to teach y makyng of
a dial, to know the hours of the nyght
by the circle whiche the two starrs, called the Guardians, The Guardians
or the mouth of the horne, doo describe by the mouyng of
the first moueable. But for as muche as it is a common
opinion, that in the myddest of Aprill it is mydnyght
when the Guardians be in the head, whereof they take the
beginnyng of the yere, I wyl declare how it ought to be what is myd-
nyght. Certaynly is, that to be mydnyght, is none
other thyng, but the sunne to be by the mouyng of the
first moueable, to every one in that parte of his Meridian
that is to hym vnder the earth, euen as is to him midday,
or noone, when to hym it is in that parte of the Meridian
that is above the earth. And in this present yere of 1545.
(to be out of doubt hererof) I have experiance with a pre-
cise Astrolable, so that the first or foremoule Guardian starre,
being perpendicularly ouer or above the South starre, I
founde in the meridian, where the sunne maketh myd-
nyght, the 11. degree of Taurus, whereby it followeth, that
the sunne being in this degree, whiche is at the 11. of
Apill, the laste Guardian starre shalbe perpendicularly ouer
the

The second part.

The North starre, whiche is the lyne of the head, and consequently the sunne being in the 9. degree of Scropio, whiche is at the xiii. of October, the guard starre shalbe in the lyne of the feete: and by this calculation may be knownen when it shalbe in the ryght arme, or in the leaste, and in al the other lynes: so that they manysellly erre, that accompe the midnyght at the xv. of Aprial, when þ first guard starre is in the lyne of the head, accompting a tretie or third part of an houre sooner and more then they shoulde doo.

In error.

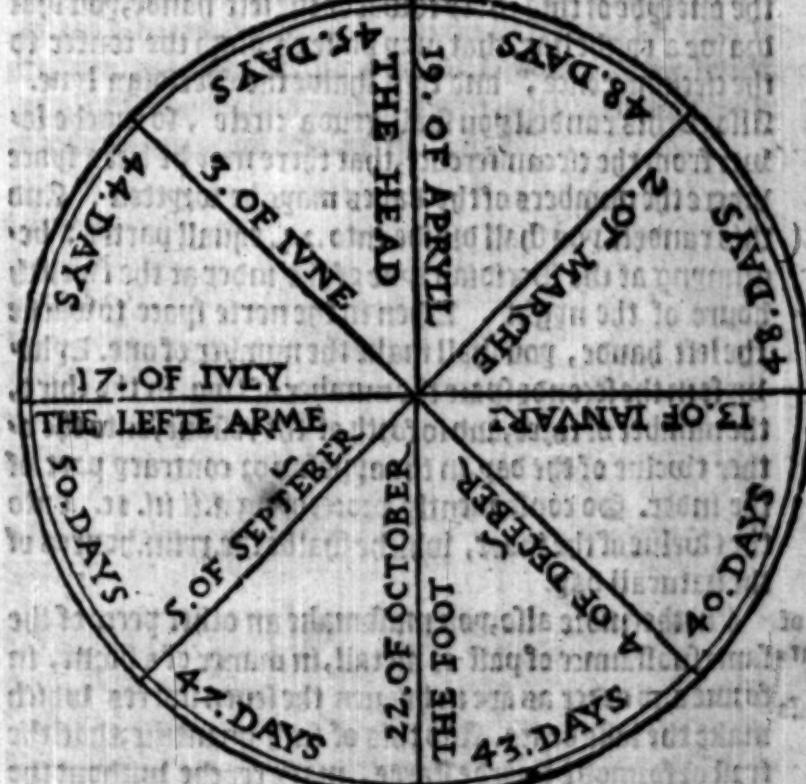
The makynge
of the instru-
ment.

Having thus gewen principles for the instrument, you shall procede in the makynge therof, as foloweth. In pastre, or on a plate of laton, make a circle of the quantite of a spanne, or of the bygnesse that you desyre the instrument or Dyall to be: then make an other circle somewhat less; so farre distant from the greater, that betwene the one and the other may be a space, in the which may be signed or marked the dayes and monethes. Likewise shall you make an other less circle, leauyng space to set the numbers of the dayes of every moneth. And under this circle, shal you make another, leauyng space to write the names of the monethes: then shall you diuide the first and greatest circle into eyght equall partes, so that the xii. of Aprial maye be in the hyghest or uppermoste parts of the instrumente, whiche is where they saye the lyne of the head to be, and the xiii. of October must be in the neather parte. Also, the xii. of January, in the ryght arme: and in the leaste arme, the xiii. of July, and so the other dayes that doo fall to the other lynes, according as they aunswere to the right assencion of the sunne, as you may see in this figure.

This beyng thus diuided, you muste also diuide the spaces that are betwene the one lyne and the other, into the dayes whiche be numbred in euery space: so that betwene the xii. of Aprial, and the thirde of June, are 45. dayes, and that space shal you diuide into 45. partes. And whereas the instrument beyng small, it canne not in so lytle space receave so manye partes, you shall diuide it from true, to true partes, and so shall you diuide the other spaces by the numbers that are signed in them.

Then

When one daye moare before the .x. towarde the lefftband,
you shall make a syrke, and there shalbe the .xx. of Aprial.
And syue dayes moare before, make another syrke, and
there shalbe the .xxi. And yet other ffeue dayes moare before,
whiche shalbe the .xxvi. of Aprial) make an other syrke ouer-
thwart vnto the neathermost circle, and there shal Day
begynne. And from these dayes shal you begyn to accompt
the dayes of Maye from syue to syue. And in the last space
you shal put syre, whiche shall make the one and thyytis
dayes that May hath.



xxxi. 107
The second part. I

And therell shall you make an other syrke which shal trayn
uerse or ouerthwart vnto the lesse circle. And in this man-
ner shall you diuide the other monethes, geyng to euer
of them the number of his dayes.

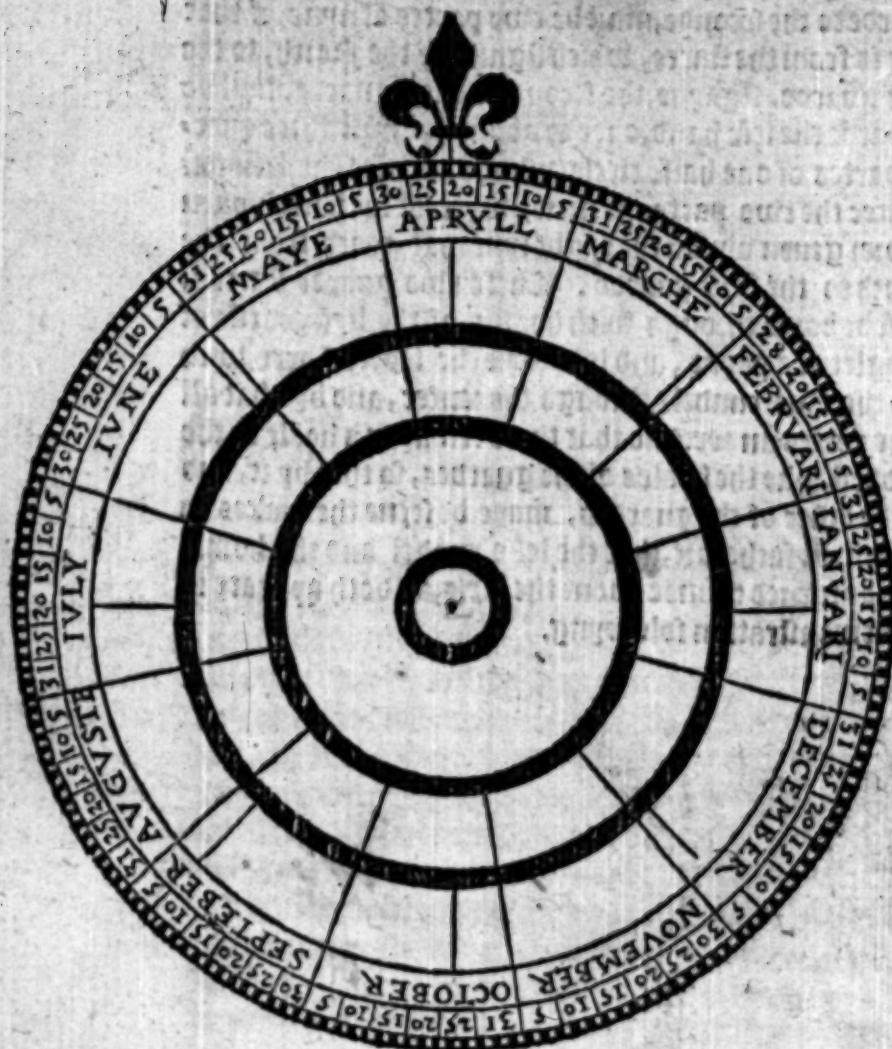
This being done, vpon the outwarde part of the great
circle, you shall cut rounde the paper, past, or plate of la-
ton, leauing of the same for a signe or marke a floure De-
lince vpon the. x. of Aprill, for that it muste be the head:
and lykewyse at the. xxi. of October, may be left a han-
del to holde it by. Then muste you make a rundell of the
same paste or laton, of the bygnesse of the lesse circle,
Without the circumference whereof, shalbe left a tooths
or inder, in the whiche you shal wryte, Tyme. And from
the one syde of this inder towardes the left hande, you shal
drawe a ryght line, that may passe through the center to
the circumference, and this shalbe the Meridian lyne.
Also to this rundell you shall geue a circle, so muche lo-
wer from the circumference, that there may be left a space
where the numbers of the dayes maye be wrytten. And this rundell you shall diuide into .24. equall partes: be-
gynnyng at the Meridian lyne of the inder at the twelvth
houre of the nyght. Then in the nexte space towardes
the left hande, you shall make the number of one. Lyke-
wyse in the seconde space the number of two, in the third,
the number of thre, and so forth of the residue, vnto the o-
ther twelue of the day, in the opposite or contrary part of
the inder. So consequently proceeding. i. ii. iii. &c. vnto
the twelue of the inder, whiche shalbe the. xxiij. houres of
the naturall day.

The horne of the seven star-
res whiche make the lesse
make the lesse bears. And this of such quantitie, that the
same substance of past or metall, in maner of a horne, in
forme and order as are in heauen the seven starres which
make the lesse bears. And this of such quantitie, that the

fyre or formolle guarde starre, maye reache without the
great rundell close to the circumference thereof: hauyng
the North starre his center, with the center of the instru-
ment. And from this starre or center, vnto the fyre and
formolle guarde starre, muste be a ryght lyne, by the whiche
the horne muste be cut neare from the center, vnto the dis-
coueryng

coneryng oþ shelwyng of the houres. Also from the syþte
garde to the seconde, must be two partes of nyne, of that
that is from the starre, which signifieth the þorth, to the
syþte garde. Agayne, the second and last garde, must be
towarde the left hand, ouer oþ above the syþte, three quar-
ter partes of one halfe circle (whiche hath for the Semidi-
ameter the two partes of nyne, whereof we have spoken
before) geuen vpon the ryght lyne that goeth from the
þorth to the syþte garde. These two garde starres,
must be boorded througþ with hoales of the byggenesse of
an aglet of a poynt, and lykewylle the þorth starre, with
also the two rundels througþ the center, and by that all
three peeces annered, so that there remayne a hoale in the
myddest, lyke the hoales of the guardes, so that by it, and
by the other of the guardes, maye be seene the starres in
heauen, in suche sort, that the lesse rundel and the horne,
may be turned rounde about the Axis, as doth appeare in
the demonstration folowing.

The second part.



To finde the
hour with
the instrument. The instrument thus ended, and brought to perfection,
when you desyre to knowe the houre, you shall turne
the index of the lesse rundel (in the whiche is wrytten,
Tyme to that part of the great rundell where is marked
the day in the whiche you desyre to knowe the houre:
and directyng your face towarde the North, you shall
make the head towarde the heyght of heauen, at the 19.
of Apryl

of Ap̄yll. And seyng in heauen by the hole in the myddel the starre of the North, holdyng the instrumente in suchе compasse of the face, that by the circumference of the greater runder, maye be seene the Guarde starres in heauen, you shal turne the horne rounde about, vntyl it fall vpon the Guardes: so that by the two holes of the mouth of the horne, the two Guarde starres maye be seene, and by the hole in the myddel of the North starre, and al three with one eye: then the ryght lyne that goeth from the North to the firsle Guarde, shall shewe in the less runder, the houre that shalbe.

The. xviii. Chapter, of the time of
the tydes, or rysyng and falling
of the sea.



Keate accompte ought Pilots & partners to haue of the tides, to take porte, enter vpon barres, passe by flottes, and finally, for all manner of nauigations. For being ignozaunt her eos, grcate hurt and inconuenience myght channce vnto them, as did of late to the valiant captayne Don

John Gulinian the Earle of Siebla, in the yere of. 1436. who was drowned before the citie of Gribaltar, for that the Maryners kept none accompt, neyther had consideracion of the tydes. By reason wher eos, not onely he was drowned, but also with him dyed many worthy gentlemen, and valiant captaynes of Spayne.

The Maryners holde for a certayne rule, that the moone being in the Northeast, or in the Southwest, is full sea: and being in the Southeast, or Northwest, to be halfe water. They affirme also, that at the fyfste daye of the newe moone, the sunne being at Northeast, and a quarter to the East, (that is Northeast, and by East) the moone shalbe Northeast, and then shalbe full sea, and three houres, and three quarters.

The Maryners opinion
of ebbynge and
flowyng of
the sea, or ty-
des.

Observacion
of the moone
to knowe the
tydes.

The second part.

And at the seconde day of the Moone, when the Sunne shalbe at East Northeast, the Moone shalbe at North-east, and then shalbe full sea, and soure houres and two quarters. *sc.* Theyr accompte is, that the Sunne beyng in the North, is mydnyght: and beyng in the Northeast, theyr accompt, three: and in the East, sixe. So that theyr accompt three houres from wind to wynde, by the eight principall wyndes, or lynes, whiche the Spanyardes call Rumbos. These wyndes muste be imagined vpon the North, placed in the Angle, vnder, or beneath the earth: and the sunne and the Moone at the moouyng of the firste moouable, and they ought not to be imagined in the Horizon, as the compasse sheweth. For speakeyng by the tearmes of astronomie, you muste vnderstande, that the Moone touchyng in the circle of houres, at the number of three, is euer full sea: and touchyng in the same circle, at the number of nyne, is euer lowe water. So lesse ought they to obserue firste accompt of the houres, by quarters of houres. For, to gene 30. dayes to the Moone, it shalbe necessarie to accompt by the syghtes of houres, as shalbe sayde hereafter.

Here is to be noted, that the Spanyardes thynke (by lyke) that a Northeast and Southweast Moone, maketh a full sea in al other places, as it dooth in Spayne. But in that they are greatly deceaued, and therefore the rule that they hauie set forth for the tydes, serueth onely for such places where it floweth Northeast and Southweast Moone a full sea.

The moone
causeth the eb-
byng & flo-
wyng of the
Ocean sea.

The moving
of the moone.

And the better to vnderstand the increasing and decreasing of the Ocean sea, it shalbe conuenient to knowe the cause thereof, wherunto we say, that the Moone is the cause of ebbing and flowing, or rysyng and falling, increase or decrease of the sea: not onely by her lyght, but also by her secrete or hid propertie. The Moone compasseth about the earth, from the East into the West, vntyll she returne to the place or poynte from whence she departed: and in this course walseth or spendeth so muche more then one naturall daye, in howe muche her proper moouing is moare then the Sunne against the firsle moue-

able, so that she maketh her turns or course about the four quarters of heaven in .xxiiii. hours, & four fifties of one hour, whiche are the .xiij. degrees that she goeth more then the Sunne. And in this tyme the Ocean increaseth and decreaseth twylse, so that this increasyng and decreasyng, answereth directly to the course of the Moone: whereby it foloweth, that the sea increaseth sixe hours and one fyfth part, & decreaseth other sixe hours, and one fyfth. And yf this day at the .xiij. houre, was full sea, the lowe water shalbe, at the syxt houre and one fyfth part: and at the .xiij. houre and two fyfth partes it shall retorne to be full sea: and at the syxt houre and three fyfthes, shalbe lowe water agayne: and at the .xiij. and four fyfthes of the other day, shalbe ful sea. So that from one daye to another, the tyde doth shorthen four fyfthes of an houre, which is the tyme that the Moone tyde slacketh or targeth, more then one natural day, to retorne to the poynct from whence she departed by the .xiij. degrees, wherof we haue spoken. Whereby it manifestly appeareth, howe they beguyld them selues that say, that The shorthening of the In error.

For if it were so, the tydes should ever be at one selfe same tyme and houre. But so as muche as there is more then .xxiiii. hours, by the sayde four fyfth partes, thereby is caused the variation of the tydes: so that yf this daye, the tyde be at one of the clocke, to morrow it shalbe at one and four fyfth partes, and the daye folowyng, at two of the clocke and three fyfthes. &c.

The variation of tides.

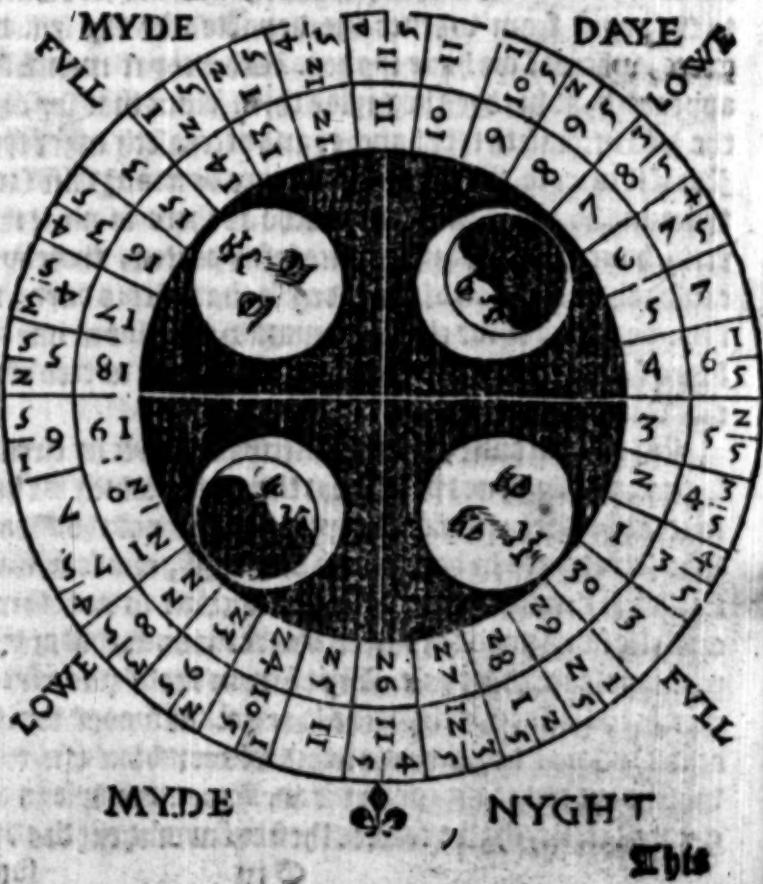
For this account, I wyll describe a Table in circular sygure, although not precise, for the causes which we haue touched before in the fist Chapter, speaking of the Moone: who sometymes in her mouynge is swyft, and sometimes slacketh as much, because the coniunction is not ever in one selfe same poynct of the Zodiacke, as the Mariners presuppose for theyr rule. This sygure shall have two circles, in the lesse (which shalbe the syrst, and next unto the center) shalbe the dayes of the Moone, from one to .30. whiche we count the coniunction. And in the second and greatest circle, shalbe founde the houres of the tydes. So

Gj that

The seconde parte.

that, who so desyreteth to knowe when the tyde shalbe, where it shalbewth Southwest and Northeast, let hym at that houre take heede to the dayes of the Moone, how many they are: as yf she be in the coniunction, or yf it be the syxte or seconde of the Moone. &c. And the day being known, then in the seconde circle whiche awnswereth directely to the daye, shall he fynde when shalbe hgh water, or full Sea: and consequently, the ebbe, or lowe water, whiche shalbe syre houres and one fyfth, after the full Sea, and so lykewyse may he iudge when shalbe the halfe tyde: and this aswell at the tyme when it encræaseth, (whiche shalbe thre houres and halfe a fyfth part of an houre, before the full Sea) as also when it decreaseth, whiche shalbe the halfe ebbe, thre houres, and halfe the fyfth of one houre, after the full Sea.

The Table foloweth.



This increasing and decreasing of the tydes, is not
ever in equall quantitie. In the coniunctions and oppo-
sitions, they increase and decrease muche, whiche the Mar-
iners call hgh spryng tydes, and the greatest increase of
all, they call the hgh sprynges. In the quarters of the
Moone, (which are at the 7. and 22. of the Moone, or neare
there about) they increase and decrease but lytle: whiche
the Mariners call nepe tydes, lowe waters, dead waters,
or lowe fluddes.

The xix. Chapter, of certayne signes, whiche
prougnosticate tempestes, or fayre weather.



Good Pilot or Mariner, ought
not to be ignorant of certayne
signes or tokens, whiche the na-
turall Philosophers describe of
tempestes. For as they signifie
vnto him, so shall he leane his
post, or enter into it: which if he
can not, then ought he with pa-
tience and hope, to tarry the time

that God hath appoynted for him, who moueth and trou-
bleth the seas when it pleaseith him, & appeaseth them a-
gaine at his pleasure. Lesse hurteth & damageth the strok
which we see comming, or foresee, then that whiche hath
striken vs, & taken vs carelesse. When the sunne riseth faire
& cleare, it signifieth a fayre day: but if it shewe yeallow, or
deadly, tempest is like to follow. Againe, if at the rysing of
the sunne, his beames shew them selues contract, or gathe-
red togeather, & short, you shal haue raine: yf the milles or
cloudes make a circel about y sunne or moone, holly much
the greater that circel haue, so muche greater shalbe the
tempest to come: and if there shalbe two circles, the tem-
pest shal increase the more. And if it chaunce, that at the ry-
sing of the sunne, the cloudes be turned red, it is a signe of
no small tempest. When the sunne or the moone shal haue
a circel looke towarde the parte where it breaketh, & from
thence shal wynde come: yf it departe, or disparte equally,
 faire weather shal follow. When the moone riseth bright &

Signes of
fayre & follow
weather.

The second part.

shynynge with pure colour, you maye judge it faire wea-
ther: and if red, wypnd:ys blacke, rayne. When in the new
Moone, þ hornes oþ corners appearre grosse oþ great, it is
a token of tempest: and if sharp, it signifieth faire weather.

The newe
Moone.

This that we haue saide, is the authuritie of Plinic &
Aristotle, to whom the prudent Parcyner shal credite, un-
tyl he haue founde other more certayne, eyther by his
owne experiance, oþ by the experiance of other wylle men,
woþthye to be beleene. And every man ought to
trauayle as muche as in hym is, for the knowledge of
these thynges, accordyng as God hath geuen hym under-
standing and reason to obteyne the same: and this shalbe
wyldome, bearing in memorie the experiance of thynges
past, to gouerne presently, and to yrouide soþ thynges to
commie. The prouidence of God is so greate, that depen-
ding bywte beastes of reason and understanding, he hath
geuen them sense, and naturall instincte, whereby they
maye knoue that, that menne doo understande by reason.

The sense of
beastes, in soþ
seeyng tem-
pestes.

Antes.

Swallows.

Fyfhes.

Spates. x. vii.

By this sense and secret instincte of nature, the Antes
oþ Swallows, with prouidence and diligence, laye vp
in stoeþ they; prouision and egges, when before they feele
the rayne to come. The Swallows also when they feele
the wynter comynge, passe the Seeas. Lykewylle, the Fyf-
hes, when they perceave stowmes to come, goe downe to
the bottome of the water, and hyde them in the muddle of
the See. And although it may seeme beside my proffession,
to meddle with matters parteynyng to Diuines, yet wylle
I not omit to speake that Christ our Lorde sayth, as
testifieth S. Matthewe. When the Pharisées with the
Saducees (to tempt hym) wylled hym to shew them sig-
nes from heauen, he answereþ, saying, When it is eve-
nyng, you say it shalbe faire weather, because the hea-
uen is redde: and in the morynge, you say it shalbe tem-
pest, when you see that the heauen dwylcth towards
redde, &c. They knewe by that they iudged of heauen, to
determine thinges to come: as whether it were euill to
take iourney, to enter the sea, to reape Corne, to laye it
abroade, oþ to geather it in. I saye, that to understand the
reason that mooued them to haue suche conyderation of

time,

lyme, (which we no livelyke wylse obserue,) it is necessary to knowe that the redde colour whiche appeareth in the evenyng, signifieth the drynesse of the ayre, whereby of the evenyng, the matter of the grosse vapours which shoulde be conuerted into water, is so much driesed, that it appeareth in manner inflamed, and is therefore redde, and so is it not aptly disposed to be conuerted into water, and is therefore the nearest signe of drye weather. The other signe, when the heauen in the morwyng draweth toward redenesse, (yet not redde) sheweth manyselby that rayne shal folow. Whereof the cause is, that this matter is ingrossed, because this colour can not be but in grosse and thick matter, whiche is not driesed, and therefore is not redde, as the cloudes that appeare in the west, in the lyme of sayre weather: but it is a matter somewhat troubled, and partly redde, and is therefore a confounded matter, which toucheth with the heate of the sunne, and therewith broken and dispearsed, falleth downe, and is conuerted into water. And further, as touchyng the sayde troubled o; grosse matter, I saye, that the drye and ruddie parte thereof, is eyther turned into wynde, by drynesse, o; els beyng compassed about, and inclosed with moyste matter, is altogether conuerted into rayne, and so maketh tempest. For by tempest is meant, not onely rayne, but also tempestuous wyndes, with water. what is tempest.

Lykewylse it is written by saint Luke, When yon see a cloude ryse in the west, you say rayne shal folowe: and when the wynde bloweth South, you say it wyll be hotte. To understande this, I say the cause of this is, that rayne is made, o; engendred of moyste vapours, whiche both maye be, and are ingrossed. O; other wylse, a cloude is a grosse body of moyste vapours so ingrossed, and when the cloude doth so ryse, it shalbe a signe that rayne shal shortly folowe. For that that was ingrossed in the cloude, shall soone be resolued into water. To the other reason, why they say that when the wind bloweth South, it wyll be hotte, I saye that that wynde is hotte and drye. Furthermore is to be considered, that the windes are sometimes dry, and sometymes moyst, yet not by their owne

Ruddy the colour.

Luke. xii.

The generation of rayne o; cloudes.

The qualities of wyndes.

The seconde parte,

propertie, but accordingyng to the Regions by the whiche they passe. We see that in somme one Region it rayneth with one wynde: and the selfe same wynde in other places disperseth the cloudes. The Northwest wynde is drye in Spayne, yet in Lybia is it very moist and rayn. The South wynde in Europe, causeth rayne in moste places, and therefore the Poetes named it the wynde of waters, and this wynde in Palistina or Iurie is drye. The cause of this diuersitie, is, that when that wynde bloweth in palestina, it passeth by hoate and drye Regions, as by the desertes of Afrike, and passeth not by any sea at all. But when it bloweth in these partes of Europe, it musse of necessitie passe by, and ouer the waters of the Sea Mediteraneum, or the Leuant sea, where it geathereth moysture, and causeth rayne. The Leuant or East wynde, in Malaga, and Gibraltar, is moyste, and in Sheres De la Frontera, is hoate as hell.

* The xx. Chapter, of the bryght and shynynge exhalations that appeare in tempestes, whiche the Mariners call Santelmo, or Corpus sancti.



Ignorance is the mother of errours, and therfore wyll I not omit to shew the naturall cause hereof, although among certayne simple and ignorant people, it is accounted for a myacle, that in certayne tempestes on the sea, the Mariners see certayne shynynge & bryght fyres, whiche with great super-

ition they kneele dolone unto, and pray unto, affirmyng that it is Santelmo that appeareth unto them, and not contented herswithe, somme swere that they haue scene droppes of greene ware fall downe. Other affirme that this ware is of suche heate, that if it fall from the top of the shyppe, it doth melte the rosen and pitche of the hatches of the shyppe, with such other foolishe imaginations, and therefore it shalbe good brieslye to speake hereof, to shope

Some call
these the fiers
of S. Elin
and Haynt
Nicolas

Stoppe the mouthes of suche sondे and ignorant persons.
 The exhalations or vapours of the grosse fumes or smo-
 kes that ryse from the earth, are constrainyd or geathe-
 red togeather by the coldnesse of the nyght, and the ayre, &
 are thickned in the firshe region of the ayre, nert vnto the
 earth. This may, and is wont to be inflamed or kyndled,
 and yf it finde a body wherunto it may cleane, it aby-
 deth in that vntyl it be consumed. This fire is cleare, and
 shynynge, and yet burneth not. The Grekes call it Poly-
 deuces: and the Latines call it castor and Pollux. It is ac-
 customed to appeare vpon the shrowdes, and oftentimes
 is seene vpon the pykes of souldiers in the armes of men
 of warre, as Plinie wryteth, and this, as wel by reason of
 continuall smoke, as also by the heate of muche people.
 Certayne it is, that smoke is none other thyng then fire
 dispearsed: as flame is an exhalation or evaporation that
 ryseth in maner of a smoke, from a grosse or fat body, and
 at the tyme that it ryseth, beyng geathered togeather, is
 constrainyd into flame, invested with fire. This re-
 splendence or shynynge, is also ostentynge scene, not
 only in lourneyng by land, but also in sayling by rivers:
 and when it appeareth on the lande, it riseth of the smoke
 that is geathered togeather with the colde ayre of nyght,
 and on the bankes of ryuers: this smoke is geathered of
 the exhalations of the water, and consequently being kin-
 dled, appeareth bryght and shynynge. But nowe let vs
 come to the shypes that sayle by the sea, and to the Ma-
 ryners that are accustomed to tempestes. To them there-
 fore I say, that that light, or such other lights as they see,
 is engendered of the fumes & smokes of their shippes, with
 the heate of menne couched close and neare togeather in a
 narowe place, and when a tempest ryseth, the sayd smoke
 is thickned, press togeather, and beaten downe by the
 wyndes, in suche sorte, that beyng tossed from one syde to
 an other, it is set on fire by mouing, and taketh holde
 sometyme on the shrowdes, and sometyme on the top, and
 sometyme also in the poupe, or in the foreshyppe: So that
 to see this light, or the same to appeare, is a natural thing,
 and not supernaturall.

wandering
fires engen-
dered of ex-
halations and
vapours.

Castor and
Pollux.

what's smoke
and flame.

Exhalations
of the land and
water.

Exhalations
& vapours en-
gendered in
shippes.

The second part.

Shynnyng sye

A superstitious opinion of the Marynery.

A sye of the Frer preachers.

Testimoniis of
ancient aucthoris.

When captyaine Beyerra was at Coron, in the Empesours nauie, with his companie of Souldiers, he chaunced to be in a tempest, and sawe the sayd syre of Santelmo, whiche shortlye after dessended so lowe, that the captyayne myght easly come to it: and takynge it in his cloke, he sounde it to be a litle droppe of water. Somme haue thought it to be a certayne shynnyng sye, called Taros, whiche the sea men sometyme see in a calme in the Sommer season: and thus Santelmo appeared no more. The captyayne remayned astonisched at the mokerie, and the other perceaued it to be no miracle. The opinion of the Marynery that affirmed it to be Santelmo, maye ryse of Saint Crasmo, Byshop of Naples: who (as they saye) not onely in his lyfe tyme, but also after his death, was a patrone and helper of Marynery that called vpon hym in tempestes. This name of Crasmo, they of Naples, call Cremo: and processe of tyme takynge awaie one.e. by the sygure of Winope, remayned the name of Santelmo. And the Spanyardes, who never canne long keepe anye strange vocable, call it Santelmo, turnyng.r. into.l. Yet of this Santelmo, whereof the Marynery speake, there is neither scripture that maketh mention, nor anchoritie that confirmeth it. I heare say, that the Frers preachers, had a religious man, of commendable lyfe, & good conuersation, named Frer Pero Gonzales, boorne in Galizia, and that in his lyfe tyme, our Lord dyd certayne miracles by him, and that this is he that shyneth and geueth light in tempestes. No doubt, but God woorketh miracles in his Saintes, and by his Saintes, as sayth David. But if this seruaunt of God was Pero Gonzales, how then shal he be Santelmo? Another difficultie there is, as touching this lyght: for there are swytynges of more antiquitie then the lawe of grace, and commyng of Christ in fleshie, whiche gene testimonie heros. For the Poet Virgil, in the seconde of his Aeneidos, swyteth, that this fire appeareth vpon the head of Iulius Ascanus. And Titus Livius in his firste booke, affirmeth, that it appeared vpon the head of Seruius Tullius, the syxth Kyng of the Romanes.

Pomponius Articus saith, that Rome begunne to be buildyng in the thysde yere of the thirde Olympiade, that is, in the tenth yere of Iothan kyng of the Jewes. And from the creation of the wold 3201 yeeres, and 729 yeeres before Christ our Saviour was borne, the kynges of Rome were seven, and raigned 244 yeeres. Eusebius sayth, they raigned 246. Servius Tullius raigned 44. yeeres, Tarquinius Superbus 29. yeeres after hym. So that discountyng these yeeres, it shall appere clearely as I say. And although the yeeres were not discounted, let them reade Diodorus Siculus, an ancient wryter, let them reade Plutarchus, Aristotle, and other old ancthours that hane wrytten hereof, and they shal finde, that tempestes be neare vnto the sea, these fires and lyghtes appeare in them: and appeared not onely to the Gentiles, but at this day also appeare to the Turkes & Moores in tempestes. When onely one lyght appeareth, it is taken for an euyll signe: And herof sayde Proportius thus.

Candida felici soluite vela toro.

And why it is an euyll signe, this is the cause, that ys One light or the tempest that ryseth be greate, it choketh the erhalation, although yet by the parte leasse troubled, it appeareth. When there are two lyghtes, it signifieth that in the ayre is great aboundaunce of grosse humours, and is a token that it is sufficient to consume the matter of the tempest, or that the tempest begynneth to ceasse, and the grosse humour hath the maisterie. But sometime it chaungeth, that two lyghtes apparyng, there may be tempest, and one apparyng, shall not be so greate, and oftentyme there is tempest, without any lyght at all seene. The blind gentilitie called these Castor and Pollux, and placed them in heauen in the signe of Gemini.

Nowe remayneth to aunswere to one obiection of the Maryners, who say, that never man that hath seene Increour of these syres, hath perished. To this I say, that manye the Maryners may see, and have seene these lightes, of whom, some have ben in peryll, and some downed: Notwithstanding, no man

The second part.

man can affirme, that yf the drowned myght speake, they
woulde say that they had scene them. Therfore the wisse
Christian Martyner ought to have a cleare consci-
ence, and to call for the helpe of almyghtie God,
lifting vp his eyes and handes vnto heauen,

Psalm. liv. viii. and say with the Prophet, Saluum me fac

Deus, quoniam intrauenit aqua vsque
ad animam meam. Sane me, oh my
God, for waters haue entered
even vnto my soule,

Chere endeth the seconde parte.

The thirde part, entreateth of the composition and vse of Instrumentes, and Rules for the Arte of Navigation.

* The fyrist Chapter, of the number, order, and names of the wyndes.

So greatlys esteemed was Eolus, <sup>why Eolus
was sayned</sup> kyng of the Colas Ilandes, or ^{I-} ^{God of wyr-}
landes of Vulcane, for having rea-
son and knowledge of the wyndes,
that they of auncient tyme called hym
the God and Lord of them. Whith no
lesse consyderation, the prudent Mar-
iner ought not to be ignorant of them, soz as moch as the
uniuersal benefite, & commodite of Navigation consisteth
therin. And to haue the better knowledge therof, you shal ^{what is wod?}
understand, that wynde is fruite of the ayre, & vapour of
the earth: the whiche by reason of his subtiltie, pearceth
the Ayre, stryketh it, & ensoyleth it. Other say, that wynde
is Ayre, moued or tossed by the vehement influence of
vapours of contrary qualtie. It is in Latin called, Ven-
tus, because it is vehement, and violent, whose force is so
great, that it overthoweth not only heapes of stones, or
rockes, & casteth downe trees: but also disturbeth the ayre
and the earth, & moueth the seas. There are fourteyn ^{The 14. wt. ym-}
principall wyndes, whiche come from the fourteyn cardinall ^{or} ^{14. ciphi of Car-}
principall poyntes of the Horizon: we haue sayd that the ^{dinal of Wyndes}
Meridian circle, cutteth the Horizon in two poyntes, (that
is) in the North and in the South, and the Equinoctiall
cutteth it in other two, that is, in the East and West, and
From these fourteyn poyntes, come these fourteyn wyndes, wher-
of also the holy scripture maketh mention. These fourteyn
wyndes, they in auncient tyme, named in this manner.
That that commeth from the East, they called Subsol-
nus, which we call the Levant, or East wynde. That to ^{the} East
meth from the South, they named Auster, which we call
the Meridian, or South wynde. That commeth from the South
West, they cal Eauonius, which we cal ^{the} Ponent or West, west
That

The thirde part.

North.

Collaterall
wyndes.

Twelue
wyndes.

Eyght whyle
wyndes.

Division of
the Horizon
by the fourre
principall
wyndes.

Eyght halfe
wyndes.

That from the North they named Septentrio, or Aquilo, or Boreas, which we call North. To every of these fourre wyndes, they adioyned two collateral wyndes, in manner as followeth. That that is from the East towarde the parte of the North, where the Tropike of Cancer aryseth, or commeth forth, they called Vulturnus: and that that is from thence towarde the part of the South, where ryseth the Tropike of Capricorne, they called Eurus: also that is from the West, towarde the part of the South, where the Tropike of Capricorne goeth downe, they cal Aphricus: and that that declineth to the North, where the Tropike of Cancer goeth downe, they call Caurus. The collateralles of the North and of the South, answereth to the circumferences of the Polar circles: that that is from the North towarde the Levant, or East, they call Aquilon: and that declineth towarde the West parte, they call Circus: that is from the South towarde the East, Euro Auster, and toward the West Euro Aphricus: thus many hath Aristotle in his Metheora, with these xii. wyndes, they sayled in olde tyme, and madetheir compasse by them.

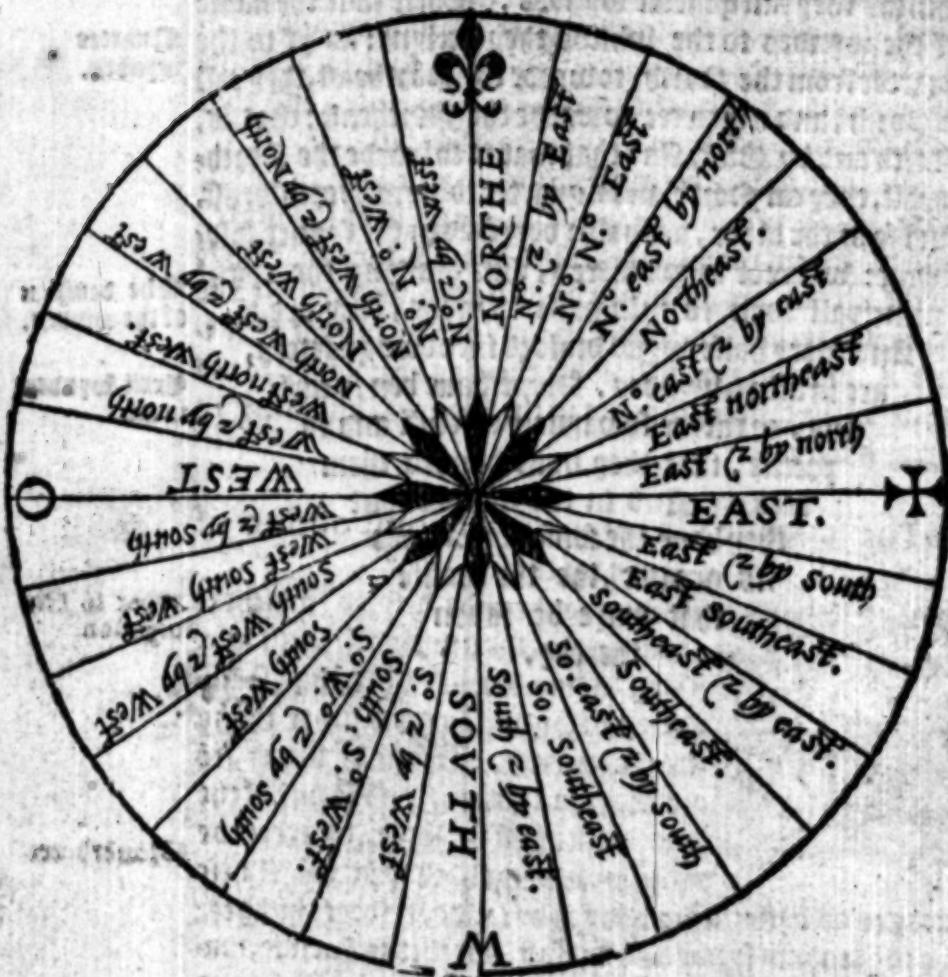
The Hydrographers of late dayes, and suche as are trauayled and exercised in saylyng, agree with the aucterites in the fourre princiall wyndes, although they haue chaunged the names, calling the Levant or Orient, East; the Ponent or Occident, West: the Septentrimoniall, North: and the Meridionall, South. Betwene these fourre wyndes, they diuide everye quarter of the Horizon, into two halffes, made of the two nearell, in this manner: Betwene the North and the East, takyng name of them both, they name the North East. Betwene the East and the South, they name the South East: and betwene the South and the West, South West: betwene West and North, North West. These eyght wyndes in nauigation, they cal whole wyndes.

Betwene these eyght wyndes, they place other eyght, that are called halfe wyndes, whiche also are named of the two that are nearell vnto them: That that is betwene the North & North East, they call North North East: betwene

Betweene North and East, is Eastnortheast: and so forth
of the other. Besyde these halfe wyndes, they haue other
whiche they call quarter wyndes. These take the name
of the wyndes to the whiche they declyne: as ys to the ^{Quarters} ~~Wyndes.~~
quarter from the North, towarde the Norththeast, they call ~~Wyndes.~~
it North, and a quarter towarde the Northeast: that is,
North and by East. And that that is towarde the North-
west, they cal North, and a quarter toward Northwest.
And so of the other, as shalbe veryfyed in the sygure folo-
wyng: whereof is geathered, that diuiding the eyght
principall wyndes into halfe wyndes, they are. ^{The denisition} ~~of the windes.~~
And every halfe wynd diuided into two quarters,
are in all. 32. wyndes. Some haue ben so curi-
ous, or rather so baynely carefull and to
precise, that they haue diuided them
into. 64. And in the Cardes that
they haue, the confusyon of lines
is greater, the the profite
that maye be taken
thereby.

The

The second part.
The demonstration of the wyndes.



These names do they use that sayle by the Ocean sea.
And it seemeth that they had their beginning of the
maine or Flemishe tongue: For these nations chestly
sayle in the Ocean. They that sayle in the sea Mediter-
aneum, or L'uar' sea, call them by other names, takyn-
g

The names
of the wyndes
in the Italian
or Tuscan
tongue.
original of the Tuscan or Italian tongue. Dels that
they haue denomination of the partes from whence they
come in respect of the sea Mediteraneum. As the wyndes
called Greco, because it cometh from Grecia. And Libico,
because

because it commeth from Lybia, and Syrocco, because it cometh from Syria. And beginning at the North, these are their names, Tramontana, Graeco, Leuante, Ponente, Maestro, and that that is betwene Tramontana and Graeco, they call Graeco Tramontana, and that is betwene Graeco and Leuante they call Graeco Leuante, and that is betwene Leuante and Syrocco, they call Leuante Syrocco, and that is betwene Sorocco and Mezzo Iorno, they call Mezzo Iorno Syrocco, and so of the other: and the lyke of the quarters. And because they that sayle in the Ocean, are gouerned by altitudes, we wyll use the names that they use, where we intende to intreat of altitudes, and every man shall use them as he lyseth, soz as much as the difference is not in the wyndes, but only in theyz names.

*The seconde Chapter, of the composition of Cardes soz the sea.



Arriving to the ende desyred (whiche is what is ~~me~~ Navigation, the principall intent why ~~me~~ nigation.

I beg in this worke I say, that Nauigation or sayling, is none other thyng then to journey, or viage by water, scō one place to another, and is one of the soure difficultest thynges, wherof the moste wyse kyng hath witten. These

Proverb xxx.

byages do dyffer from byages by lande, in thre thynges: for the lande is fyrm and fersall, but this is florible, wavering, and moveable. That of the lande, is knowen and termined by markes, signes, and limites, but this of the The danger
and difficultie
of Nauigation. Sea, is uncertayne and unkownen. And if in byages by lande, there are hilles, mountaynes, rockes, and crag-
gie places, the sea payeth the same seuen folde with tormentes and tempestes: wherfore these byages being so difficulte, it shalbe harde to make the same be understande by wordes or wryting. The best explication, or inuenti-
on, that the wittes of menne have founde soz the man-
ifestation of this, is to gene the same paynted in a Carde.

For the draughte, or makynge whereof, it shall here
gresse to knowe two thynges: wherof the one is, the Making of
Cardes in
the Sea.

the

The second part.

The wyndes
or lynes are
called Run-
nes, in the
Spynshe
tongue.

The mother
compasse of
the Carde.
xxx. I. nes
which signifi-
fie so manyn
wyndes.

the ryght position of places, or placing of countreyes and coastes. The other is, the distances that is from one place to another, and so the Carde shal haue two descriptions. The one that aunswreth to the position, shalbe of the wyndes whiche the Mariners call lynes or poyntes of the compasse: and the other that aunswreth to the distances, shalbe the drawyng and poynting of the coastes of the lande, and of the Ilandes compassed with the Sea. To paynt the wyndes, or lynes, you muste take skynnes of parchment, or large paper, of such bygnesse as you wil the Carde to be, and in it drawe two ryght lynes with blacke ynke, whiche in the myddest shal cut or diuide them selues in ryght angles, the one accordyng to the length of the Carde, which shall be East and West, and the other North, and South. Upon the poynct where they cut, make a center, and vpon it, geue a p[er]tue or hydde circle, whiche may occupie in maner the whole Carde. This circle, somme make with lead, that it may be easly put out: these two lynes divide the circle into four equall partes, and everye parte of these shall you diuide in the myddest with a p[er]che or puncte. Then from one punt to another, drawe a ryght Diametral lyne with blacke inke: and so shall the circle remayne diuided with four lynes, into eyght equall partes, whiche corresponte to the eyght wyndes. In lyke maner shal you diuide every of the eight into two equall partes, and every part of these is called a halfe wynde. Then drawe from every punt, to his opposite Diametral a ryght lyne, of greene, or azure: lyke lyse shall you diuide every halfe wynde in the circle, into two equall partes. And from these punctes, whiche diuide the quarters, you shall drawe certayne ryght lynes with red ynke, whiche also shall passe by the center, whiche they call the mother Compasse, or cheste compasse of the Carde, beyng in the myddest thereof: & so shal come forth from the center, to the circumference. 32. line. which signifie 32. wyndes. Beside these sayd lines, you shal make other equall distant to them, & of the selfe same colours, in this maner. From the pointes of the windes & halfe wyndes that passe by the center, draw certain right lines, & passe

not by the center, but be equalllye distant to those that passe by the center, and of the same colours and equall distaunce, as are they that passe by the center. And as these lines concurre togeather as well in the center, as in the poyntes of the wyndes, and halfe wyndes, that are in the circumference of the circle, they shall leane, or make therre other 16. compasses, every one with his 32. wyndes. And yf the carde be very great, because the lynes may not go farre in funder, if you wyll make therre other 16. compasses, you must make them betwene the one, and the other of the syxte 16. poyntes, wher the quarters are made with theyr wyndes, as we hane sayde. It is the custome for the most part, to paynt vppon the center of these compasses, a flovre or a rose, with divers colours, and golde, differencyng the lynes, and markyng them with letters and other markes: especially signyng the North with a flovre Deluce, and the East with a Crosse. This, besyde the distinction of the wyndes, serveth also for the garnyshing of the carde. And this so, the mooste part is donne after that the coaste is drawen. And thus much suffiseth so, the draught of the wyndes.

The situation of the places, Portes, and Ilandes in the Cardes, accordyng to theyr proper differences, consisteth in the particular, and true relation of suche as hane trauayled them. And therefore for this purpose it shalbe needfull to haue paternes of coastes, portes, and Ilandes, whiche must be paynted in the Carde, and these of the best and most approued to be true: and not only to haue paternes well paynted, but also it shalbe necessarye to knowe the true altitudes of the Pole, of certayne principall Capes, Portes, and famous Citties. This done, they must be translated into certayne thynne papers, and transparent, that may be seene through: and those of the best and finest that may be had, annoyntyng them with oyle of Line seede, and then dryng them at the Sunne. Then take the paterne or Carde that is to be translated, and reach, or streatche it soorth vpon a table. Then put the transparent paper, vpon the one syde of the paterne where you wyll begyn. And the paper beyng made fast vpon the

The placynge
of many com-
passes in the
carde.

The flovre, or
rose of the cen-
ter.

The North.

The situation
of the places.
cc.

Translation
of the Carde,
from one to
another.

The third part.

paternes with plomettes of leade, or a little ware that
may easly be taken of, you shall in the transparent pa-
per marke, with a fine penne, one East and West, and
one North and South, or two, vpon thois that are seene
by the selfe same paper in the paterne. And this is called
tracyng, or translatoryng. In lyke maner shall you trac
all the coastes, Havens, Pontes, Ilandes, Cities, Capes,
and Ryuers, as appeareth in 2 Paternes, vnto the Rockes
that come soorth of the water, and the knownen banckes.
And because this paper doth not suffice, you shal put ther-
to another, and more as neede shall require. And begin
the translation, in one, where the other endeth, vntyl you
haue translated al that you desyre; not forgetting to make
in every one, lynes of North and South, East and West,
to serue for markes afterwarde. So that the lyne of North
and South, of the one paper, maye lygne close and even,
with the lyne of the North and South of the other paper
that is ioyned to it by longitude.

And the paterne thus translated into these papers, you
must put the ruled or lined paper, or papers vpon a plaine,
smooth, and stodfast table, where you shall creache them
smooth, and make them fast with plomettes or naygtes,
or nayle them to the table by the sydes and corners, with
small nayles. Then vpon the sayd ruled paper, you shal
put the paper that is translated from the paterne, in that
syde or part that is correspondent from the paterne, to the
ruled Carde, so that the lynes of East and West, North
and South, of the translation, maye be vpon the lynes that
answere to them in the ruled Carde.

This paper thus made faste by the one syde or
parte, you shall by the other syde (that it maye remayne
in his place) put vnder it another fine paper, smokey or
sunzed on the nethermost parte (whiche is that, that fal-
leth vpon the ruled Carde) eyther with a lynke, or with
matches of pitch. These thus ordered, and made faste
one vpon another, you shal take a steele bodyn, as weare
with a smooth and blunt point, that it easie not, or boore
not the paper, and with it shall you drawe, presyng vpon
all the translation, and tracyng it with diligence
and

Tracyng of
the carde.

and discretion, marking ever howe much in it is transla-
ted from the paterne: sauging the wyndes or lynes which
the Maryners call Rumbos, and so shall remayne all the
impression of the smoke in the ruled Carde. Upon the
whiche, with a lyne penne you shall trace with ynde: which
beynge dry, you shall with crummes of bread make it cleane
from all the smoke, and so shall the coaste appeare in the
Carde drawen with ynde.

This done, then with a small penne shall you de- The paynting
scribe in the Carde, all the places and names of the coastes of the Carde,
in that parte where they are, as they are seen in the pa-
terne. And besyde, you must describe in redde, the Portes,
principall Capes, famous Cites, with other notable
thynges: and all the residue in blacke. Then shall you
drawe oþ paynta Cites, Shypes, Wanners, and beastes,
and also marke the regions, and other notable thynges.
Then with colours and gold shall you garnishe and beauti-
fie the Cites, Compasses, Shypes, and other partes
of the Carde. Then shall you set forth the coastes with
greene, by the more oþ bankes of the landes, and make
them sayze to lenght with a lytle saffron, oþ other dyes, as
shall seeme best. Likewise shall you describe certayn al-
ters, with theyr significationis, in this manner.

W. for a War. C. for a Cape. O. for an Angle. I. oþ S.
for an Ilande. P. for a Pountayne. D. for a Poynt. M. for a
Wyer.

Then in place where is more roome, oþ that is least
occupied, you shall drawe two ryght lynes, equally di-
stant: and the one no further from the other then halfe
a synger, oþ lytle more, and so long, that betweene them
may be marked at the least thre hundred
leagues. And this the Maryners call the trunke oþ scale
of leagues, and place it oþ use it in this manner. They
take with the compasse, a hundred leagues of the trunke
of the Carde oþ paterne that is transla-
ted. And they set them self betweene the two lines, and this space they part
by the halfe, and reast the foote of the compasse in halfe
these diuided agayne equally into two parties, they reast the
compasse in. 25. and the 25. beynge leghtwysse diuided

The making
of the trunke
oþ scale of the
leagues.

The third parte.

they reall in xiij. leagues and a halfe, and marke them as appeareth in the demonstration following.

The gradua-
tion of the
Carde.

The Carde beyng thus made, then to graduate it, or dis-
uide it into degrees, you must drawe three lynes, whiche
make ryght angles with the lyne of East & West, equi-
distant to the lyne of North and South: and they also
shalbe North and South. These shalbe drawn by the
Ilandes of Asores, or Soria, or nearer to Spayne, or
where the Carde shalbe leste occupied. And for this pur-
pose, the one lyne must be so farre distant from the other,
that in the two spaces which they make, may be marked,
in the one, the degrees, and in the other, the number of
them, conformable to the graduation of the paterne: as the
numbers of degrees shew East and West, with the po-
tes, capes, and coastes in theyr proper altitudes.

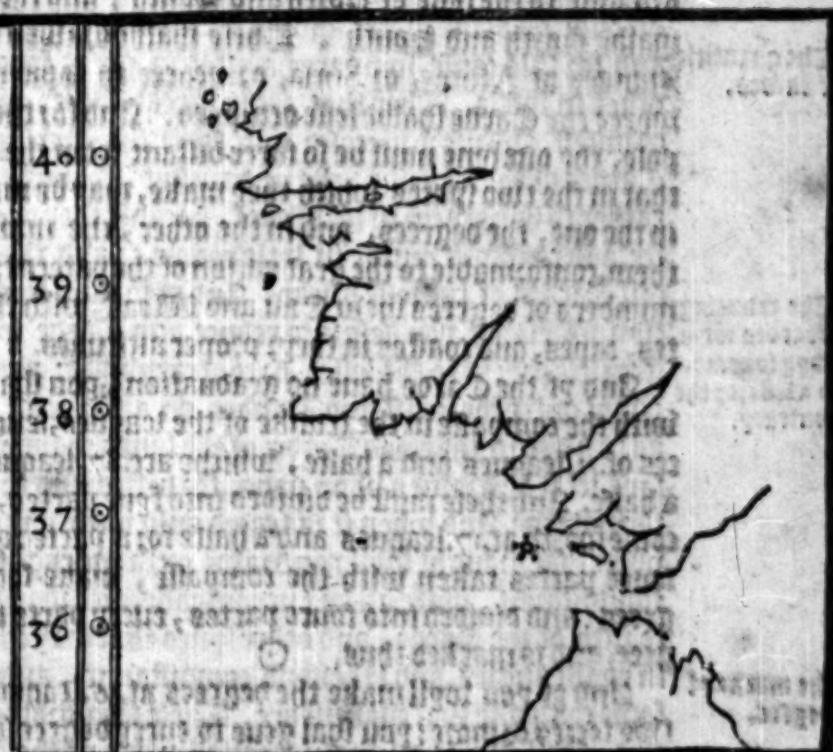
And yf the Carde haue no graduation, you shall take
with the compasse in the trunke of the leagues, seuen spa-
ces of .12. leagues and a halfe, whiche are .87. leagues and
a halfe. And these must be diuided into syue partes, which
come soorth at .17. leagues and a halfe for a parte: and the
fourre partes taken with the compasse, make fourre de-
grees: and diuided into fourre partes, every parte is a de-
gree, and is marked thus. C

The marke of
a degree.

And yf you wyll make the degrees at .16. leagues, and
two terces or more: you shal geue to every degree so much
space as the leagues comprehend. This graduation must
be begunne from some one cape, whose altitude of the
Pole is well knownen. And the whole Carde beyng thus
graduate, you must begynne the number of the degrees
from the Equinoctiall lyne, one, two, three, &c. towarde
the one Pole, and the lyke towarde the other: so hat
to the knownen Cape, maye answere the number of his
altitude. And so shall you doo to the whole Carde. Also,
the Equinoctiall lyne shalbe marked in his proper place.

And

And in lyke maner shall you marke the Tropykes accoy-
dyng as they are in the Sphare. But soasmuche as in
Spayne, Cape Saint Vincent is the principall: they be- Cape Saint
Vincent.
gynne there to make graduation, and number it in 37.
degrees. And from thence, towarde the Pole Artyke, Increasing
the degrees do increase. And from thence, towarde the Ring of the
Equinoctiall line, they demynshe: and from that lyne, degrees.
to the Pole Antartyke, they increase agayne (as we haue
sayde) as is conteyned in the Cardes, and as appeareth in
this demonstration solowyng.



And yf the paterne haue neyther leagues nor degrees, If the pa-
you must take o; knowe the altitudes of two Capes, that serve haue ney-
are North, and South, of thee degrees, and the difference ther league nor
of y degrees of the elevation, that is from the one Cape to
the other, ye shal divide al that space in so many partes, degree.
so ech one part shalbe 17. leagues and a halfe, as auncient
reth to one degree. Or accordingyng to the opinion of the
leagues of the roundnesse of the earth, as we haue sayd,

The thi rd parte.

as touchyng this in the eightieth Chapter of the syntre part. In Spayne they use with the compasse to take the space that is from Cape saint Vincent, to the myddest of the greatest Ilande of Berlinga, whiche they account three degrees: so that after 17. leagues and a halfe for a degree, they are 52. leagues and a halfe: and so muche do they put in this space. Other put 50 leagues, accountyng after 16. leagues, and two terces for a degree, and in this maner they make of leagues degrees, and of degrees, leagues. The saylyng Cardes, haue no certayne byguesse limitted them, because they only represent the description of the water and earth, and not the quantite: and for this cause, some are paynted in great space, and other in lyttle. They that are in great space, are more manifest, and more precyse: and these the Mariners call Cardes of the largest pricke or draught. Somme desyre rather to haue them in lesse space, because they are briesfer, and conteyne muche in lytle roome: and these they call Cardes of the lesse pricke. And yf for any consyderation aforesayde, you desyre to reduce any Carde from the greatest pricke to the lesse, or contrarywyse: you muste paynt onlye the coast and Ilandes on a paper, in maner as you dyd in the ruled Carde, of the lynes or wyndes. I saye, let it be drauen vpon paper, so destroying or rasing the paterne. And when it is traced only with ynke, then vpon that draught shall you drawe certayne ryght lynes equidistant, made all by one compasse, accordyng to the length of the Carde, and other lynes that may cut them in ryght angles, and lykewyse equidistant, and of the same compasse that the syntre are. These two orders of lynes, shall diuide all the superficiall parte of the Carde, into perfect squares or quadraatures. And it is to be noted, that the nearer the lynes are ioyned togeather, and the squares the lesse, so muche the more perfectly maye it be reduced, and more easly. Then shall you take another paper, greater or lesse then the Carde, accordyng to the poynt that you desyre to reduce it vnto, and in the length and breadth thereof, you shall diuide so many spaces as are betwene the lynes of the other paper: and yf it be

The quantitie of cardes.

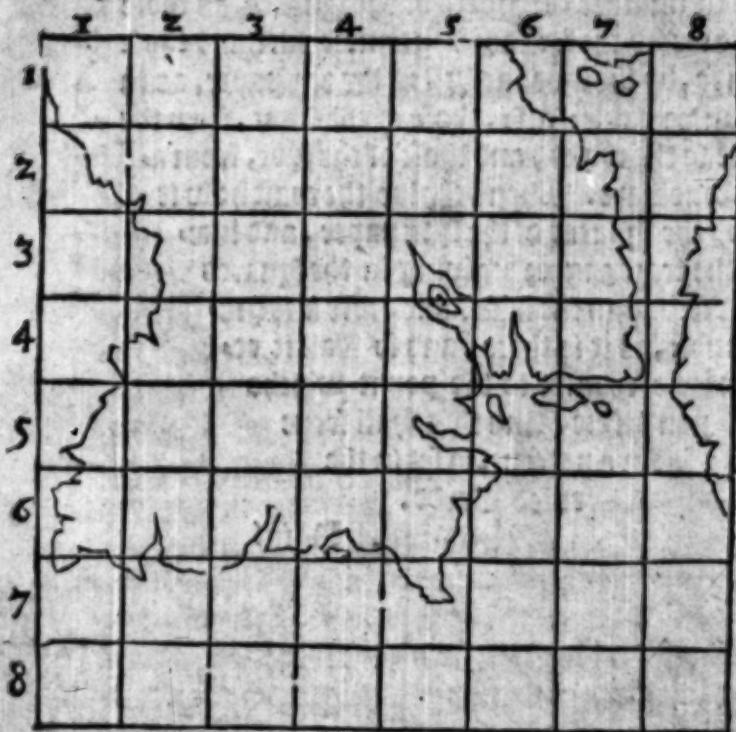
The reducing of cardes from a bryg foyrme to a lesse, or the contrary.

greater, the squares shalbe greater : and yf lesse, lesse.
To keepe order in the corespondence of the squares (whiche
the shalbe a greate lyght to translate the one from the o-
ther) you shall number the orders of the squares, as those
of the longitude, by the front or uppermost part: and those
of the latitude, by the syde, as wel in the one paper, as in
the other, conformable: also, those of the front, from the
least hande to the ryght, and those of the syde, from a-
boue, downeward. Then beholde the coast how it
goeth by the squares of the syde paper, and like-
wyse the traceyng or drawing in the squares
of the second, in the selue same order and pro-
portion, as it is there, and so shall it re-
mayne reduced to the poynct whiche
you desyre. And this shall serue
for a paterne, to set in the
ruled Carte.

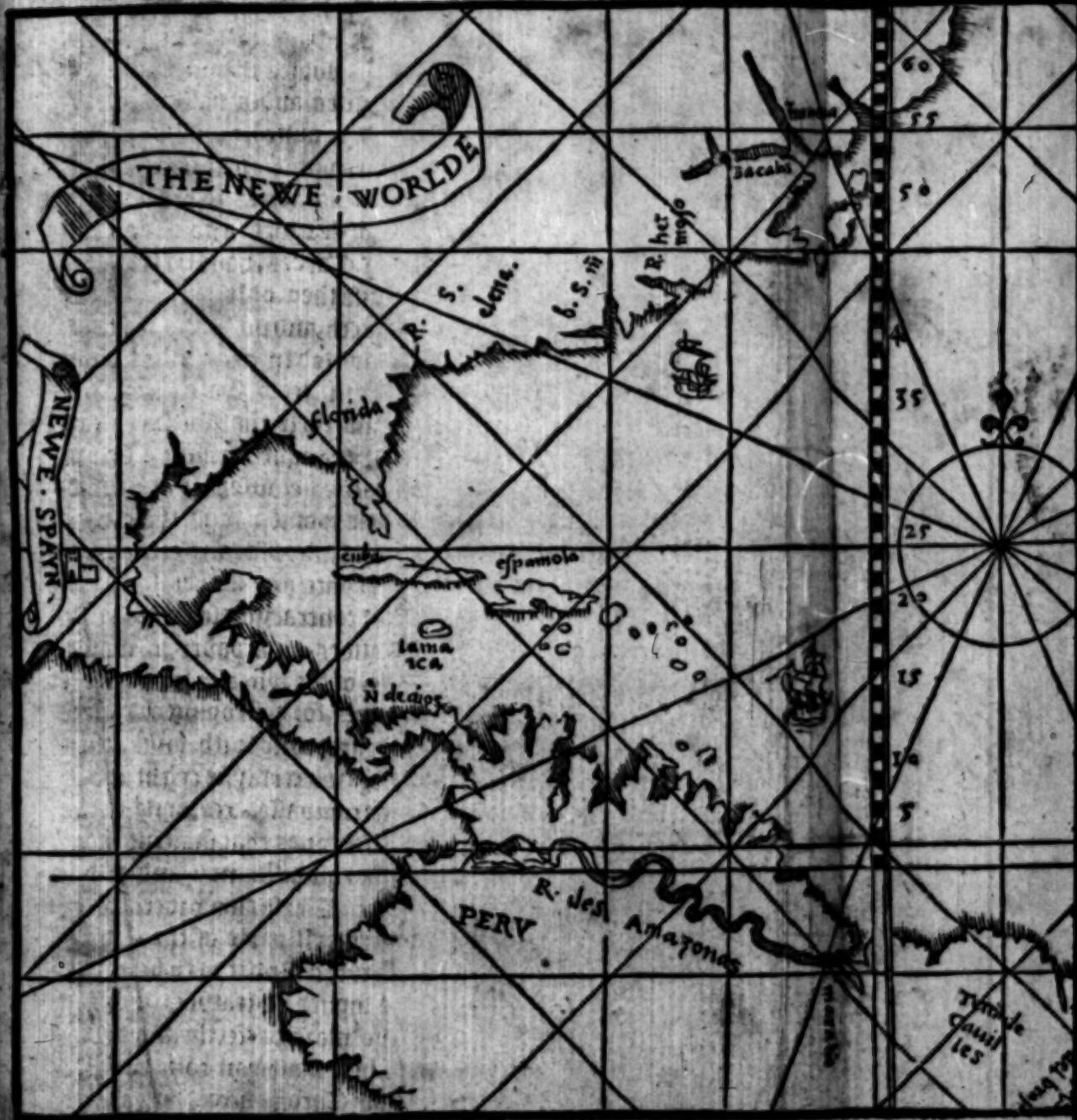
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The thirde part.

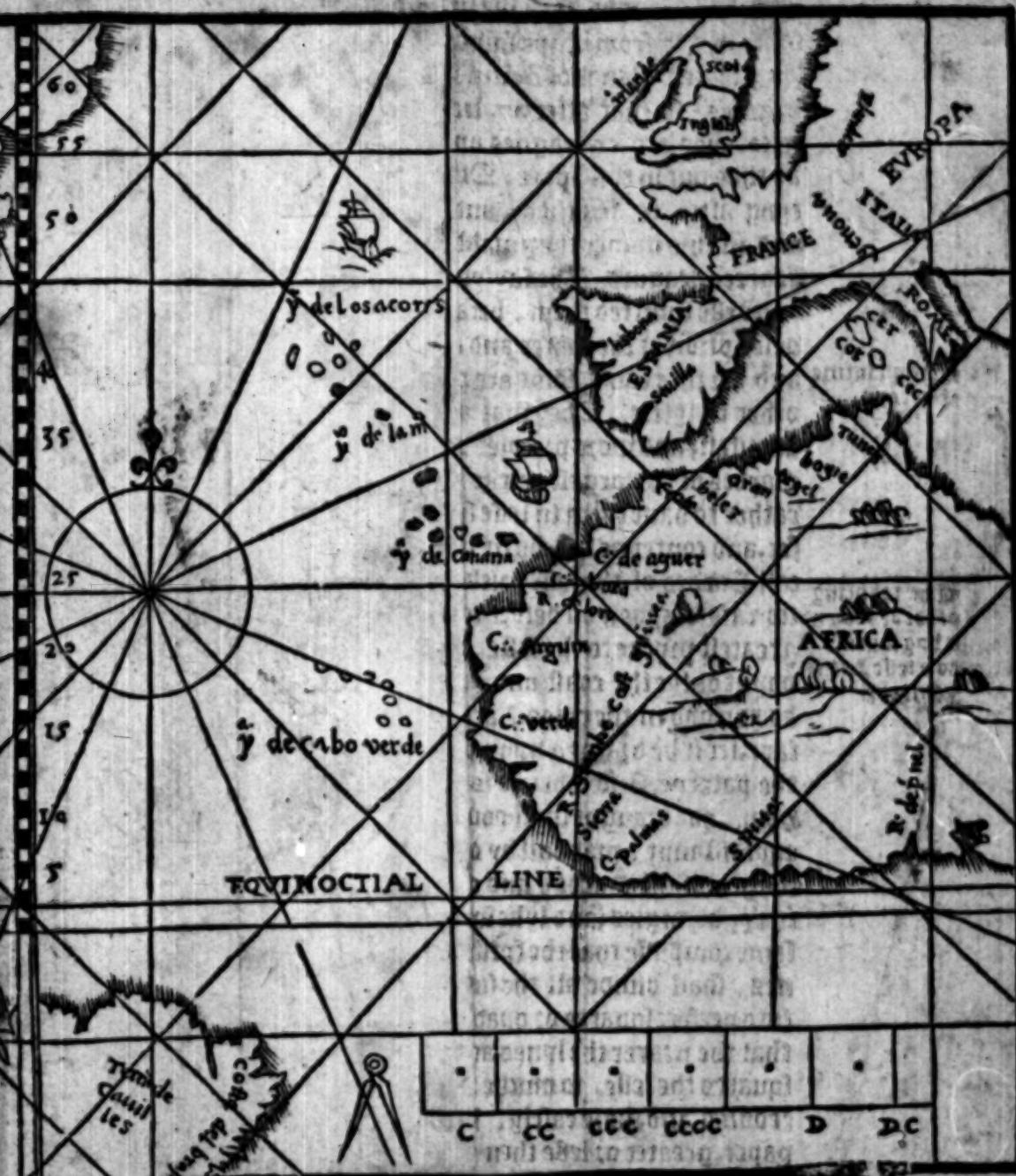
Here foloweth the manner of translatoryng
the Cardes from one sourne into another,
greater or leste.



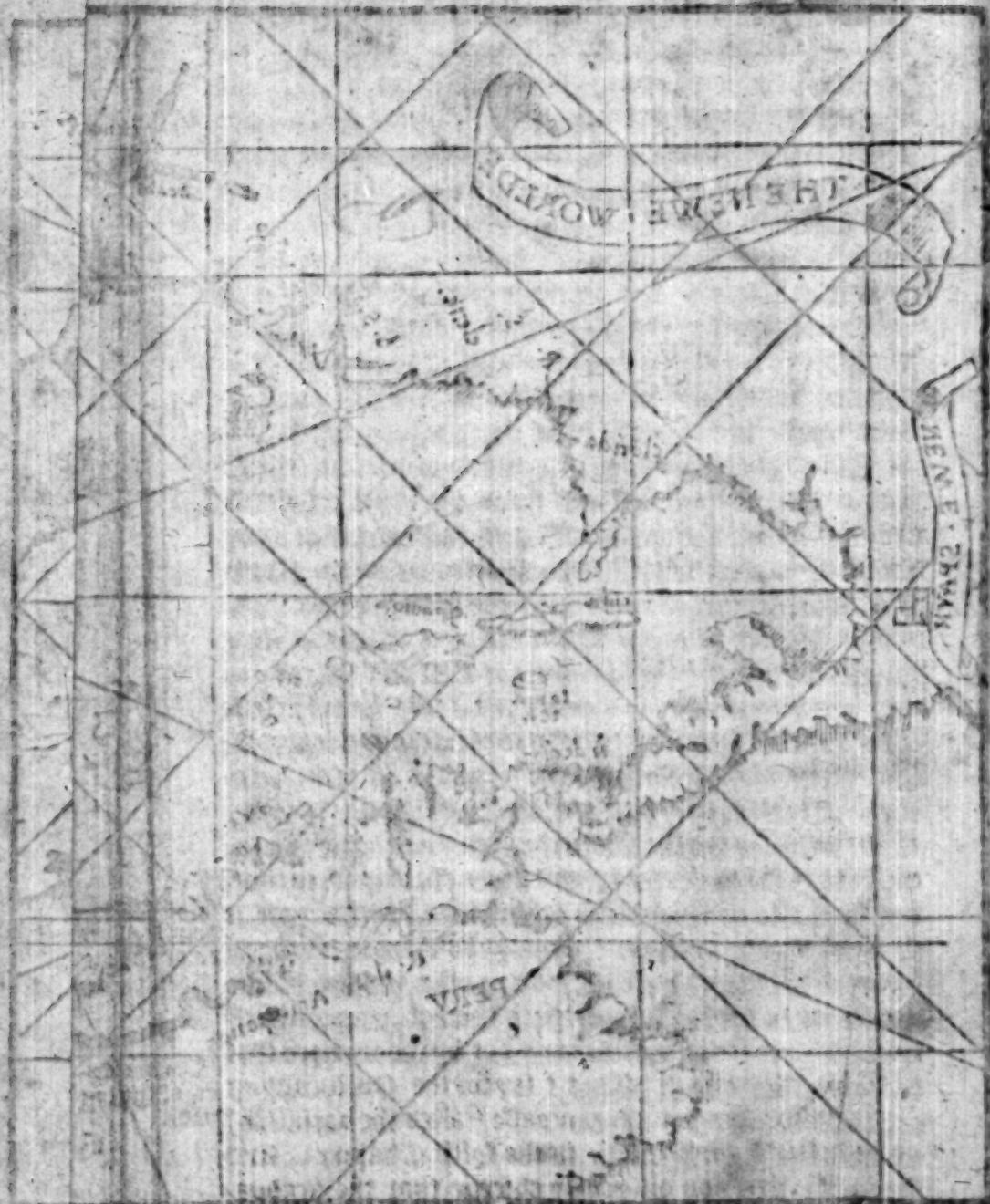
Here foloweth a similitude of the Ma-
rginers Cardes.







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The Pillettes and Marynes neyther use nor hane the knowledge to use other Cardes, then onely these that are playne, as I haue sayde. The whiche, because they are not Globus, Sphericall, or rounde, are imperfecte, and sayle to shewe the true distaunces. For in howe muche they departe from the Equinoctiall, toward whiche so ever of the Poles, the Meridian lynes are contracte narower and narower: In suche manner, that ys two Cities or poyntes in the Equinoctiall, shoulde be distaunt of longitude. 60. leagues, and in the selfe same Meridians at 60. degrees from the Equinoctiall, toward syther of the Poles, shoulde be other two Cities or poyntes, they shoulde be distaunt in longitude but onely. 30. leagues. And for the better declaration and vnderstanding hereof, I say, that if two shippes shoulde departe from the Equinoctiall, the one distaunt from the other a hundred leagues by East and West, and that syther of them shoulde sayle directly by his Meridian toward the North: then when syther of them hath the Pole ouer his Horizon. 60. degrees, the one shalbe distaunt from the other only. 50. leagues by the Paralelle of East and West: as appeareth by the playne Cardes, that they hane the selfe same hundred leagues. And besyde these consyderations, one errour bryngeth in an other: and so an other an other. Whereto speake any more here, it shalbe to certayne Pillettes (as the Proverbe sayth) not onely to genemusick to the dease, or to paynt a house for blynde menne, but shall also be an endlesse confusyon. Furthermore, it is necessarie to consyder, that good Cardes ought to haue the Coastes, Portes, Cities, & other places, situate Good cardes, according to the wyndes or lynes thereof, proportionally as they are in the worlde; and not by the wyndes that the compasse sheweth. This I say for the Northweastynge on of the compasse, or Northweastynge of the compasse (called the variation) passe. as hereafter I wyll touche in the fift Chapter. And lykewys: shall you diligently obserue, that the graduation of the Carde shewe the same in theyr proper altitudes. The Cardes that lacke this, ought to be corrected and amended by wylle and expert menne: Sauyng that

The playne
Cardes are
imperfecte.

Example of
errour in the
playne cardes.

The igno-
rance of cer-
taine Pillettes.

The variati-
on of the com-
passe.

Altitudes.

The thirde parte,

In the narow that in the Lenant sea (called Mare Mediterraneum) and
seas they sayle in the Chanell of Flaunders (called the narowe seas) it
not by the ele- is not inconuenient for the Navigation, that the Portes
nation of the be marked in the Cardes by the wyndes, whiche the
Pole.

Correction of
the sea carde.

The west
Indies.

Charles the
Fifth.

In the narow that in the Lenant sea (called Mare Mediterraneum) and
seas they sayle in the Chanell of Flaunders (called the narowe seas) it
not by the ele- is not inconuenient for the Navigation, that the Portes
nation of the be marked in the Cardes by the wyndes, whiche the
Pole. Lykewise, it shall not be incon-
uenient, but rather very necessarie (to auoyte so manye
errores, of the whiche doo shewe greate daungers, and
suche a confusyon) that your Maestie shoule commaund
certayne learned Cosmographers, and expert in the arts
of saylyng, to verifie the altitudes of the Pole, that are
of Portes, Capes, Ilandes, and people by the coastes
of the Sea, and in lyke manner truely to describe the
coastes of the lande, especiallye of the Navigation of
the West Indies, or Mundo Nueuo, where it hath plea-
sed God that so manye nations and people haue receaved
the water of holy baptisme, commynge to the knowledge
of the true God, whereby the Christian Empyre is
greatly amplyfied, besyde the greate rychesse had by the
sayde Indies. And this hath God miraculously wrought
by the conquesstes of your Maestie, in subduyng infidels,
and Gentiles, to the obediencie of the true Catholique
sayth. Wherby, not onely God hath ben well pleased,
but also your Maestie hath receaved perpetual fame, with
eternall renoume, and immortall glori to your posteritie
in woldes to come.

The.iii. Chapter, of the vertue and propertie of the Lode Stone, called in Latin, Magne, and in Spanish, Piedrayman.

The



He Lode stone (as wryteth Cardinall Cusanus) hath substance, vertue, and operation. His vertue is engendred of the Lode of his substance, essence, or beyng, stone. and of his essence and vertue procedeth his operation and effect, in such sorte, that this stone communicating his vertue to Iron, by reason therof, causeth the Iron to moue, although betwene the one and the other be a cuppe, or plate of Syluer, or a table, or any other lyke thyng.

The attractiue, or drawyng force of the Lode stone, causeth the nature of Iron to be, and rest in it, and that so symely and quietly, that beyng naturally heauye and ponderous, it descendeth not, bccause his nature resteth not in hym selfe, but is unite with the nature of the stone, whiche seemeth to extende it selfe, and as it were to caste sooth a lyuely spirite of enchauntyng vertue. In somuch that (as we see by experiance) by the sayde unio[n], it not only distributeth his vertue to one Iron, but that Iron lykewyse to another, and that other agayne to another: and so forth, bntyll of many rynges, or lynges of Iron, be made a chayne.

Saint Augustine (as he wryteth in his booke, De Civitate dei) dyd marueyle that he sawe an Iron moue it selfe vpon a vessell, by mouyng the Lode stone vnder the vessell.

It is called Magnes, because the inuentour, or synder thereof was so named: who (as Plinie wryteth) keeping cattell in Easte India, had his shooes soled with plates of Iron, and Iron nayles, such as they use in Gasconie, and had in his hand a stasse with a pyke, or hoke of Iron: and restyng hym selfe vpon a quantitie of this stone, coulde not remoone his feete, neyther lyft vp his stasse. Then staying a whyle astonyshed, as ignoraunt of the cause, at the length began to perceane the propertie of the stone, and to vnderstande the attractiue vertue thereof, (the colour of it differeth not from Iron) and was therfore called quicke Iron, or lyuing Iron.

Vertue at-
tractiue.

Cusan applic-
eth this to the
glorified body
of Christ, ac-
cording to
these wordes.
If I shalbe
exalted, I wyl
drawe all vnto
me.

The first part.

Sundrye
kynedes of the
lode stone.

The lode
stone of
Spayne.

The Ilande
of Elua.

The lode
stone of Den-
marke.

The lode
stone of Ethi-
ope.

Diuers opint-
ons of the lode
stone.

The qualities
and properties
of the lode
stone.

The partes of
the lode stone.

what part of
the stone an-
swerto the
North, and
South.

The best kynde of thei stones, is of Azurine, or blewe
colour, as the sea sometymes appeareth.

Of these, are founde syue kyndes or differences. The
first is, of Ethiope. The second, of Macedonie. The third,
of Lechio in Boccia. The fourth, of Troada, neare to A-
lexandria. And the fift of Asia. But at this day, it is
found in dyuers other places. It is founde also in many
places in Spayne: as in the hyl Morena, neare vnto the
village of Calera, beyng of the order of saint James, in the
prounce of Leon. Lykewylde in a hyl of Moron, in the
territorie of the Earle of Vrenia, is great quantite there-
of, and in dyuers other places. The stone that we most co-
monly use, is of the Iland of Elua, of the Lord of Pomblina,
which I judge to be better then that of Denmarke. This
and the other, haue vertue to drawe yron vnto them. And
trewest is that Teanixedes writheth, that in Ethiope is
found an other kynde of this stone, that putteth yron from
it. Aueroes the commentator of Aristotle, denieth that

Magnes draweth iron vnto it, but sayth, that iron by his
naturall inclination, doth moue to the stone, as to his na-
tural place, by a certayne qualite, which the stone impre-
seth in iron. And besyde this vertue and propertie that it
hath to drawe iron vnto it, it hath also another: and that
is, that it geneth vnto iron vertue and polvre, to shew
the two pointes of the Horizon, where it cutteth the Mer-
idian, that is in the two wyndes, of North, and South.

These vertues are found more intent, in only two partes
of the stone: and these are ever opposite, or contrary the
one to the other, and so are they contrarie in operation.

For iron touched with the one part, and placed where it
may moue freely, wyl shewe the North: and an other
iron touched with the other part, wyl shew the South.
Spyndynge this experiance, may be knownen, what part of
the stone answerto the North, which the Mariners
call the face of the stone, and lykewylde of the South.

This ston is so necessary, that without it, na-
vigation shoulde be imperfecte and uncertayne, be-
cause it geneth lyfe to the needle and compasse, which
leadeth and guideth the pilotte, that he may go certayn-
ly in

ly in the day, and not erre or wander in the nyght. Also The bse and
it sheweth and directeth to compasse the worlde, and to makynge of the
knowe the wyndes. And therfore, so; alsmuch as the com- Maryners
passie is so necessarie, we intind to shew the order and man- compasse,
ner howe it ought to be made, so; it maye chaunce to faille,
or be lost in the viage.

The. iii. Chapter, of the makynge
of the Maryners compasse for
Navigation.



Ahe suche passe of paper, wher
of Cardes are made, and make
in it a Circle, of the quantite of
a spanne, or little more or lesse.
In the whiche you shall paynte
the 32. windes, with theyr co-
lours, in suche order as we
gave in the firsse and seconde
Chapter of the wyndes, and of
the Cardes, not forgetting to marke the North with a
floure deluce, and the East with a crosse. And more then
this, may every man garnishe and beautifie the same, as
seemeth best to his phantasi. Then on the lower or nether
part of this passe, you must draiwe a lyne, whiche shalbe di-
rectly under that of the North and South: whiche shalbe
the marke for the setting of the Irons and Steele. Then
shall you take wyze of iron or steele, of the byggenesse
of a greate pynne, or accordingyng to the byggenesse
of the roundenesse of the passe, floure, rose, or flye, as it
maye be called. This wyze muste be bowed double,
so that enyrye of the partes may be equally as long as
the Diameter of the flye, and a quarter parte more.
The endes or poyntes of these irons or steeles, muste be
pinched togeather, and made close, and open in the myd-
dest, the one from the other, vntyll the endes come to
be equall with the extremities of the Diameter of the
flye, and so shall the steeles remayne in manner in fourme
of an egge. These wyzes or irons muste be made faste in
the

The floure de-
luce, and the
crosse.

The flye.
floure, or rose
of the com-
passie.

The thirde parte.

The lyne of the North and South.

the neather parte of the syre: so that theyre extremities, en-
des, or poyntes, come precisely by the lyne of North and
South. And to ferre oþ fallen them so, they must be couered
with a thynne paper glued, leauing the poyntes and en-
des uncovered: And these endes must be touched with the
Lode stone in this manner.

The touching of the needle with the lode stone.

The parte that is under the
flame delice, must be rubbed on that part of the stone that
answareth to the North, as is sayde in the Chapter be-
fore. And this shal suffice so, the perfecion of y compasse.

Yet some there be, that for superabundance, do to touche
the other part of the Iron, with that part of the stone that

answareth to the South, although it maye suffice to

The breaking of the stone, to drawe out his vertue.

touche it onely with the other parte.

This touchyng of
the Iron with the stone, that the demonstratiōn oþ woo-
kyng vertue may shewe it selfe soþ, must be donne with

giving certayne strokes with a hammer, on that parte of
the stone wherewith the Iron must be touched, that is to
say, in the North part, oþ the South. And from these wyl
come soþ of the stone, certayne beardes, like smal ysticles,
whereon you shall rubbe the poynt of the Iron, as you
woulde whet a knyfe: and so shall certayne of those bear-
des of the stone, cleane and stiche fasse to the Iron. And
the Irons thus touched, with y beardes cleaving to them,
you must take a prickē oþ poynt of laton of Piramidall,
sharpe, oþ scerle fourme, which is broad below, and sharp
aboue towarde the poynt. This is made round, oþ ryght
square, as seemeth belle. And in the neather parte oþ
breadth, it must be bozed (but not through) with a bozer,
whiche must also be of Piramidall fourme, and enter into
the myddell of the sayde Piramidall prickē oþ poynt of
laton, unto the myddell, oþ somewhat more. This Pir-
amidall poynt (whiche the Margyners call the Capitell)
must be of heryght halfe a finger breadth, oþ accordyng
as the compasse shalbe, and must be put through the
center of the syre, so that the poynt come soþ on the
hygher parte thereto, and must there be made fasse and
well fasse. When shall you take a rounde bore of wood,
wherin the wylle the needle maye be, not touchyng
the sydes of the same: And this must be of the heryght of

The boze of the compasse.

the

the halfe Diameter of the compasse. And the grounde or bottome therof must be set to it, as the coursyng of a bore, that it may be easely taken of, and put on, to have often recourse, to touche the gyrons with the stone, (whiche they call feedyng) when neede shalbe, that the vertue of the compasse sayle not. Also in the myddest of the grounde, or stowre of the bore, you must set a sharpe poynct or pricke made of a wyrre of laton: This must stande ryght up. And vpon the pricke or poynct thereof, you shall set the boare hole of the Capitel. And that the wyrre ente not aboue, you shall couer the bore with a glasse. And thus being touched with the stone, and set vpon the poynct, it shall shewe the true part of the North, and consequently al the other wyndes.

And here is to be noted, that after the irons or needle of the compasse hath ben touched in any of these maners, yf you bryng the North part of the stone, to the North of the needle or compasse: then wylle the North of the needle come to it. And yf you bryng the South part of the stone, to the South part of the needle, it wylle flee from it.

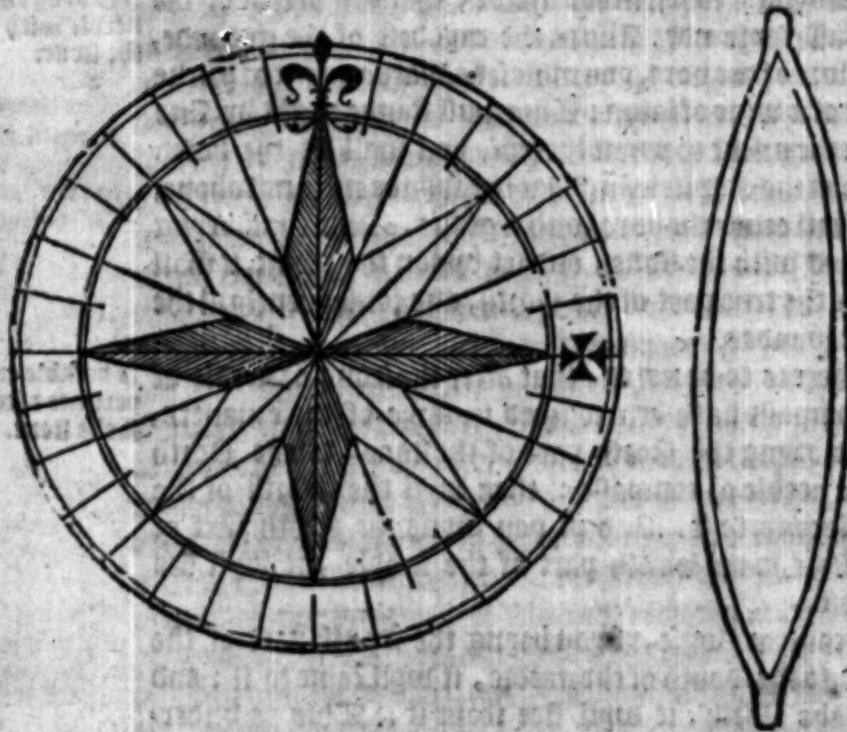
And contrarywysse, yf you bryng the South part of the stone, to the South of the needle, it wylle come to it: and yf to the North, it wylle flee from it. This is vndersteode, the needle or compasse standyng as it shoulde be. And this also is a good signe, to know whiche is the North part, and South part of the stone.

Moreover, this bore must be put within another bore, in the whiche it must hang vpon two circles of laton, and nerred the one within the other: whiche serue that the compasse waye not, or hang not toward the one syde or the other, although the shippes sways. And this bore also must haue his couer of woodre, to keepe the other. You shal lykewysse obserue that the poynct of the Capitell, and the boare thereof, and also the poynct or pricke vpon the whiche it resteth, be byrght, and lykewysse the boare, that it decline not to one part or other. And yf it be quicke then it ought to be, then make the poynct that it goeth vpon, somewhat blunter.

Fealdyng the
needle with
the stone.

A notable ex-
perience of the
Lode stone.

The thirde parte,



* The .v. Chapter, of the effect or propertie,
that the compasse hath to Northeasting,
or Northwestynge, whereby is knownen
the variation of the compasse.

The variati-
on of the com-
passe.



Any and divers are the opinions that
I have hearde, & also read in certayne
lyyters of later dayes, as touchyng
the Northeasting and Northwestynge
of the compasse, and yet me see-
meth that none doeth touche the
priche, and fewe the whyte. They
call it Northeastynge, when the
needle

needle sheweth or pointeth from the North (whiche is his true marke) towarde the Northeast: and Northwestynge, when from the North, it declyneth toward North-West. For the better vnderstandingy of these differences, whereby the needles differ or varie from the Pole, you must (beyng in the Meridian whers the compass sheweth the Pole) imagin a poynt vnder the Pole of the worlde, and this poynt to be without all the heauens conteyned vnder the syll moueable. The whiche poynt or part of heauen, hath a vertue attractive, that draweth vnto it Iron touched with the part of the lode stone, correspondent to that certayn part of heauen imagined without or vnder all the heauens, moued by the syll moueable. For yf it were imagined to be moued within any of the moued heauens, then the attractive poynt, by the mouyng of the syll moueable, and consequently the compasse, should make the selfe same mouyng in .24. houres: whiche is never seene. And therefore this poynt is not in the moueable heauens, neyther in the Pole. For if it were in it, the compasse should not varie, Northeasting, & North-Westynge. Therefore the cause of Northeastynge, or North-Westynge, or departyng from the Pole of the worlde, is, that beyng in the sayd Meridian, the attractive point and the pole, are in the selfe same, or in one Meridian: and the compasse shewynge the attractive poynt, sheweth directly the pole. And departyng from the same Meridian towarde the East (the worlde beyng rounde) the pole of the worlde remayneth to vs on the left hande: and the poynt of the attractive vertue, shalbe on the ryght hand, whiche is toward the Northeast wynde. And in hewe muche more we shall sayle towarde the East, the distaunce shall appeare greater vnto vs, vntyl we come vnto the .90. degrees: and there shalbe the mooste and greatest Northeastynge. And passyng from thence further forwarde, it shall appeare vnto vs, that the attractive poynt commith nearest and nearer vnto the Meridian lyne: and so muche shall the compasse go betteryng or auenabyng the Northeasting, vntyll it retorne to the selfe same Meridian in the opposite or contrarie part from whence they came,

The poynt attractive is imagined vnder the pole of the worlde.

The cause of the variation of the compasse.

Departyng of the pole from the poynt attractive.

The greatest Northeasting.

The thirde part.

or where they began, and then shall the attractive poynt be to them directly vpon, or agaynst the pole of the woorlde, and the compasse shall shewe, or poynt directly towarde it. And agayne, passing further forwarde, the pole of the woorlde shall remayne to the ryght hande, and the poynt attractive to the leste hande, and so shall the compasse begynne Northwestynge, increasyng it vntyl it comme from thence to the .9. degrees, and there shalbe the mooste of his Northwestynge. For turninge towarde the Meridian from the attractive poynt, it shall go aymedynge or betterynge, vntyll it returne to the selfe same Meridian from whence it departed, and there shall the compasse shewe the pole of the woorlde directly, by, or ouer agaynst the attractive poynt, whiche is perpendicularly vnder the pole. And yf from thence they shoulde turne, to passe toward the West, the pole shoulde rest to the right hande, and the attractive poynt to the leste, and so shall the variation be to the Northwest: and this is the cause of the Northcastynge, and Northwesting, or variation of the compasse. Also it is not to be vnderstode, that this Northwestynge, and Northwesting, is vniiforme, as is the departing (or accordyng to the departure) from the Meridian, wher the compasse sheweth perfectly: but rather before, at the beginnyng of the departing from the sayde Meridian, it maketh difference, or variation in a certayne quantite, and the increase that is afterwarde, is little, and so much the lesse, in howe muche the more the departing is from the sayde Meridian. For it is a passion of circles, diuidyng or cutting them selues in the sphere. So that these differences are, as are they of the declinations of the Sunne: whiche neare vnto the Equinoctials, are great, and neare to the Solstitials, are little. All the whiche shall euidently appeare in the figure followynge, whiche is a circle diuided by two Diameters, into four equal partes, cutting them selues in the center in ryght angles. And from the center poynt (called the pole) commeth forth a mouable Meridian: and in it goeth a compasse lyke lyse mouable about the circle. The attractive poynt is somewhat distant from the pole of the woorlde, and from it commeth

The greatest
Northwe-
sting.

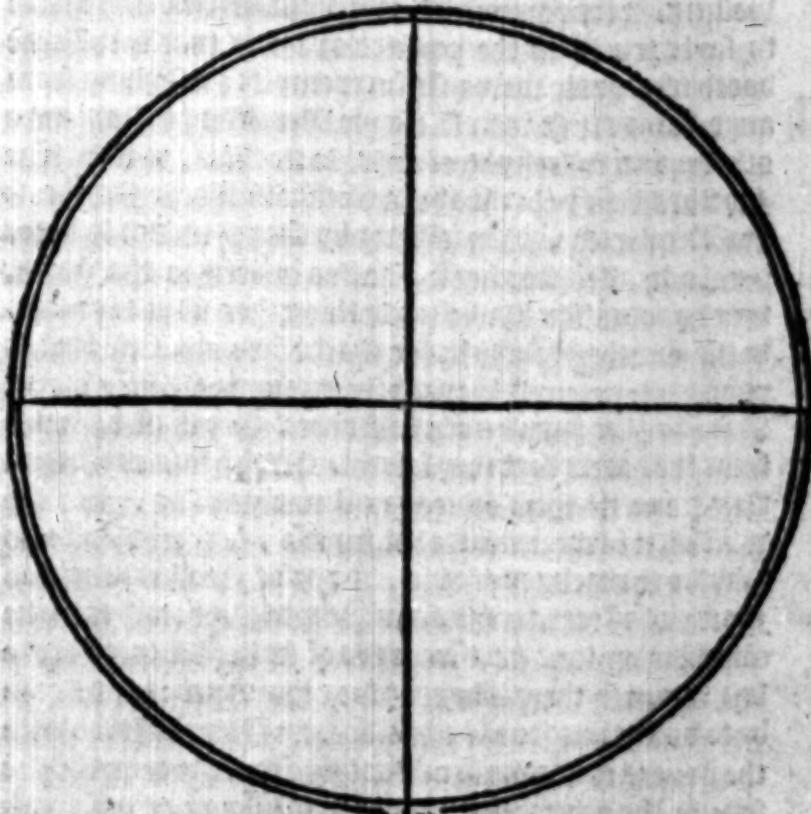
The attrac-
tive poynt is
under the pole.

The North-
eastynge and
Northwe-
sting is not
uniiforme.

The declinati-
on of the
Sunne.

It, commeth soorth a threed, which must ever passe by the North and South of the Compasse. And the Compasse being in the Meridian of the poynt attractive, that passeth by the Pole, shal shewe the Pole. And without that, shall goe Northeastynge, or Northwestynge, so varying and departing from the true Meridian that commeth soorth of the Pole of the worlde. It is the opinion of some Mariners, The meridian that the Meridian where the compasse sheweth directlye that sheweth the Pole, passeth by the Iland of Sancta Maria, and other the Pole. say, by the Ilande of Cueruo in the Acores.

Demonstration of Northeastynge.



And where as the inconuenience is manyfelle and noto-
rious, the same muste be remedied with prudence & tyme, the ground of
and not to be negligent in the vyage: but ever to use
and obserue experiance, moxe profitable then the subtile
and

The third parte.

Duertisement and curios questions of the secrete searchers of naturall
to Pilottes. thynges without experiance, whereof reason taketh his
principall grounde. And therefore, the wyls Pilot ought
to knowe by experiance, (as many of them doo not) holwe
muche a good Compasse dooth varie, Northeasting, or
Northwesting from one Porte to an other. So that to
knowe holw much y Compasse dooth varie, Northeasting,
or Northwesting, from one place to another (as to say,
halfe a quarter, or more or lesse in quantitie as they are
distant from the sayde Meridian, where the Compasses
shewe the Pole) shal in the nauigation take heede, & well
consyder, in any such viage, the Northeasting, or North-
westing, in the poyntes of the Compasse. And this shalbe
to sayle truely by the poyntes or lynes that the Carde
dooth certaynely shewe. As for example: In saylyng from
anye Ilande that is in the sayde Meridian, or from anye
other parte, in seekyng of anye Porte that is to them trus
Northeast, if by this way the Compasse shoulde Northeast
halfe a quarter, then saylyng by the poyntes or lynes of
the Compasse Northeast, halfe a quarter to the North,
theyr nauigation shalbe (excepting other impedimentes)
to the Northeast, whiche the Carde sheweth. And by this
poynt or lyne, must be made the accompte of such a viage.
And so by the poyntes of the Carde, they shall directlys
 finde the Porte that they sought. And by this order shall
they gourne them selues in all nauigations. For the
whiche, it is conuenient that wyls and experte Pilottes
shoulde make notes of obseruacions of Northeasting and
Northwesting, that is, from Port to Port, and to make
compilations and geatheringes of suche Notes, to carye
with them in theyr Shippes for regimenter: and not to
be to busie or curios to amende theyr Compasses, or with
the stone to rubbe the Irons or Steelees, neither on the one
syde or the other, from whence the floure deluce dooth

The variation shewe: For this shoulde cause many inconueniences. Ne-
ther ought they to admitte in theyr Cardes, two gradua-
tions: especially for that to knowe holwe muche in every
place the Compasse dooth goe aside, or varie from the trus
Meridian, maye easlye be made an instrument to shewe
the

the same by the Sunne in the day, and by the Starres
in the nyght.

* The vi. Chapter, of the introduction and
principles of the Arte of Na-
vigation.



Or as muche as we haue the
guide, which is the compasse, it is con-
uenient to enter into the way, whiche
is Navigation. The whiche (as we haue
sayde) is to go or passe by water from
one place to another. And this presup-
posed, I say, that he that desyreteth to
attempt Navigations, must knowe

two thynges, whiche the Cardes shall shewe hym. The one
is, by what poynt or lyne he ought to sayle: and this shal
the lynes of the sayling Carde shewe hym. The other is,
the leagues of the distaunce: and this shal the scale or
trunke of the leagues shewe, takynge with a compass
the distaunce of two places, and applying it to the scale.
The knowledge of these two thynges, ought the Pylots
to beare in memory: and to put them in effect, ought to
direct his fore shyppe to the selfe same wynde, whiche the
compasse doth shewe. For the distaunce, he ought to
knowe howe muche the shyppe goeth dayly: well con-
sidering and obseruyng the wyndes, tydes, currentes, and
all suche thynges as may be with hym, or agaynst hym.
And accordyng hereunto, he shall knowe howe muche he
hath gone, and what remayneth for hym to go, and whe-
ther he be farre of, or neare vnto the place whyther he in-
tendeth to sayle: the whiche in Navigation, is the end de-
sired. And because this estimation or computation can
not be iust and eract, especially in a long byage, or in long
tyme, it shalbe conuenient that we rectifie or amende it,
knowyng the place where the shyppe is, on the superficial
part of the water, by the place that answereþ to it in
heauen. This place of heauen, is knownen by the altitude The altitude
of the pole and
of the pole:

In Navigation,
what is
cheifly to be
consydered.

The distaunce.

The altitude
of the pole and
of the pole:

The third parte.

The Meridi-
an altitude.

altitude of the Equinoctiall, and by the altitude of the Equinoctiall and declination of the Sunne, is knownen the Meridian altitude: and contrarywyse, knowyng the Meridian altitude, and declination of the Sunne, is knownen the altitude of the Equinoctiall, and by the Equinoctiall, the pole, and by the altitude of the pole, is knownen the latitude: and this is the place that is desyred to be knownen. But so; as much as the heauen is mouable from the East to the West, this place is not knownen as a certayne poynt, but is knownen as a lyne or paralele at a certaine distance from the Equinoctial, and it is not knownen in what poynt of this paralele the shyppe is, by the altitudes that are taken from heauen: but it is knownen by the lyne that the shyppe hath gone, as we wyll further declare in the xiij. Chapter, of makyng a poynt or prickes in the Carde. And in this maner you shall haue rectified the way that the shyppe hath gone: and consequently the way that it hath yet to go.

To know the
way of the
byage.

And soasmuche as these altitudes are so profitable and necessary, it shalbe needesfull to geue rules howe we may use them to our moste commoditie. And for this, is presupposed to knowe, that all places situate on the superficiale part of the earth, and water, eyther they are under one Meridian, so that they haue, or where they haue one selfe same longitude, and differ in latitude, or are in one paralele where they haue one selfe same latitude, and differ in longitude, or are in divers Meridians and paraleles, where they differ in longitude, and latitude. And I say, that ys they haue one selfe same longitude, they sayle from the one to the other, by the lyne of North, & South, and howe many degrees doeth varye the altitude of the pole, and of the Equinoctial in heauen, so many degrees haue they gonue by sea, or by lande. If two places haue one selfe same latitude, they passe from the one to the other by the lyne of East and West. And in suchemanner of byage, the altitudes do not profit vs, because there is no variation. If they differ or varie in longitude, and latitude, they sayle from the one to the other by some of the other lynes. But there are more degrees that correspond

Rules to
knowe the al-
titudes.

Longitude
and latitude.

Variation of
degrees.

responde to the way that the **Sypp** maketh, then the degrees that varie the altitudes of the **Equinoctial**, and the **Pole**. And this difference shalbe greater, in howe muche the lyne shal drawe neare to **East** and **West**: And how muche it shall drawe neare to **North** and **South**, it shall be lesse. Of the degrees or leagues that aunsweare to everye degree of the variation of the altitude, we wyl entreat hereafter in the **xit. Chapter**.

These altitudes are knownen manye wayes: but especially by two: as, by the **Meridian** altitude and **declination** of the **Sunne** (as we haue sayde) is knownen the altitude of the **Equinoctiall**: and by it, the altitude of the **Pole**. The seconde waye, they are knownen by the altitude of some syrte starre of those that are not **hydde**. And among manye other, the **North Starre** is taken, because it is nearest to the **Pole**. To knowe the altitudes by the **Sunne**, three thynges are necessarie, that is to saye, an **instrument**, the **declination** of the **Sunne**, and **rules**. The **instrumente** to knowe the **Meridian** altitude, shalbe **The Astrolabie**, because it is mosle commodious for this purpose, whereof we wyl entreat in the **Chapter** folowing. The **declination** of the **Sunne**, (whiche is to take it awaie, or to soyne it with the **Meridian** altitude,) we haue already described in the **xyde Chapter** of these conde parte. The **rules** to knowe when the declinations must be soyned with the **Meridian** altitude, or taken from it, we wyl geue in the **viii. Chapter**. To knowe the altitudes of the **Pole**, by the altitudes of the **North Starre**, two thynges are necessarie: that is, an **instrumente**, and **rules**. The **instrument** wherewith the **Narymers** are accustomed to take the altitudes of the **North**, they call **Balestilia**, whiche is a crosse stasse, whereof we wyl wryte hereafter in the **nynt Chapter**. And the **rules** of the **Turne** or **Com-
pas**, whiche the **North Starre** maketh about the **Pole**, we wyl declare in the **tent Chapter**.

**The North
Starre.**

**To knowe
the altitudes
by the sunne.**

**The Meridi-
an altitude.**

an altitude,

**The declina-
tion of the
sunne.**

**The altitudes
of the Pole.**

**The altitudes
of the Pole.**

Jacobs stasse.

The thirde part.

The. vii. Chapter, of the making and vse of the Astrolabie, with the whiche the Mar- iners take the altitude of the Sunne.



Ake a plate of copper, or laton, which for this purpose is better then any other metal) of the bignesse that you desire to make the Astrolabie , & is comonly of the bignesse of a spanne the Diameter , and let it be of the thicknesse of halfe a synger at y least: for the waigthe that it shal be , so muche shal it be more steadie to take the altitude. This plate must be made rounde by a circle, leauing comming foorth of the circle a corner, in the whiche you shall put a ringe or handle with a hole, wherby you may hang the Astrolabie, by a threede or lyne to take the altitude. After it is thus made, with the ring or handle annexed thereto, make it bright, and smoothe, pullished on both sydes, &

The rectifyng of the Astro- labie.

The threede and plomet.

The lynes verticall and horizontall.

al of one equal thicknesse, that one side be not heauier then an other, which you shall trye in this manner: Hang the plate by the ryng or hole that you haue made , and from the same hole hang a plomet of leade , fastened to a heere, or fine threed of silke. The Astrolabie thus hangyng, free, and at libertie with the plomet , yf then the threede fall vppon the center of the Astrolabie, it is well: but if the threede doo leane or swarue to the one side , or the other, from the center, then is that side thicker and heauier then the other, and must therfore be made thynner, vntyl the threede fal fustly vppon the center. This done, make a circle vpon the sayde center , a little within the circumference of the Astrolabie . Then drawe a Diameter from the center of the hole, in the whiche the ring or handle is, vnto the center of y Astrolabie , transversing or ouerthwartynge the whole Circle . And this shalbe called the lyne of the Zenith, or Verticall poynt: whiche also shall be cut with an other Diameter vpon the center, makyng ryght angles with it. And this Diameter shalbe called the Ho-
rizon-

izontall lyne : These two Diameters shall diuide the Circle into four squall partes. After this, you shall make an other Circle, so much more within the second, that betweene the circumferences of both the circles, may be conteyned the numbers of the degrees. Then (the Astrolabie hangyng before you) you shall diuide the one parte (beyng the superior and least parte) syke, into three equal partes, and euerie parte shall conteyne 30. degrees. Then shall you diuide euerie parte of these into other three equal partes, and they shall conteyne 10. degrees : and euerie of these diuide into two partes, and they shall conteyne 5. degrees. This donne, put a ruler vppon the center of the Astrolabie, applying it to euerie of the poyntes that diuide the sayde partes, and drawe certayne lynes that passe from the circumference of the firsste Circle, vnto the lesse circumference : and in the spaces of the lesse Circle, wryte the numbers of the degrees, begynnyng in the Horizontall lyne : and in that space put syue, and in the seconde, tenne, and so foorth of the other, vntyll the 90. degrees ende in the lyne of the Zenith : then shall you diuide the spaces that are betweene the syaste Circle and the seconde, euerie space into syue, whiche shall make the 90. degrees. The Astrolabie thus made, you shall make the Alhidada or Labell. For the whiche, The alhidada you shall take a plate of laton, of the breadth of scarcely of the astrolabie two syngers, and as thicke as the Astrolabie : also, as die. long as the Diameter of the Astrolabie, and make a linc in the myddest thereof, by the longitude : in the myddest of this linc, make a Circle so great, that it may touche in the sydes of the plate : then cut of this plate on the one syde, that whiche it hath from the lyne to the ryght hande: and on the other syde, that that it hath from the lyne to the least hande, leauyng the Circle whole. This lyne that shall passe by the center of the Circle, is called Linea fiducia, (that is) the lyne of confidence : whiche is that, that sheweth in the degrees, the altitude that is taken. Then shall you take away the endes or corners of the Alhidada that are without the lyne, so that you touche not the lyne. This donne, you shall make two lytle rysyng or rayzed tablettes

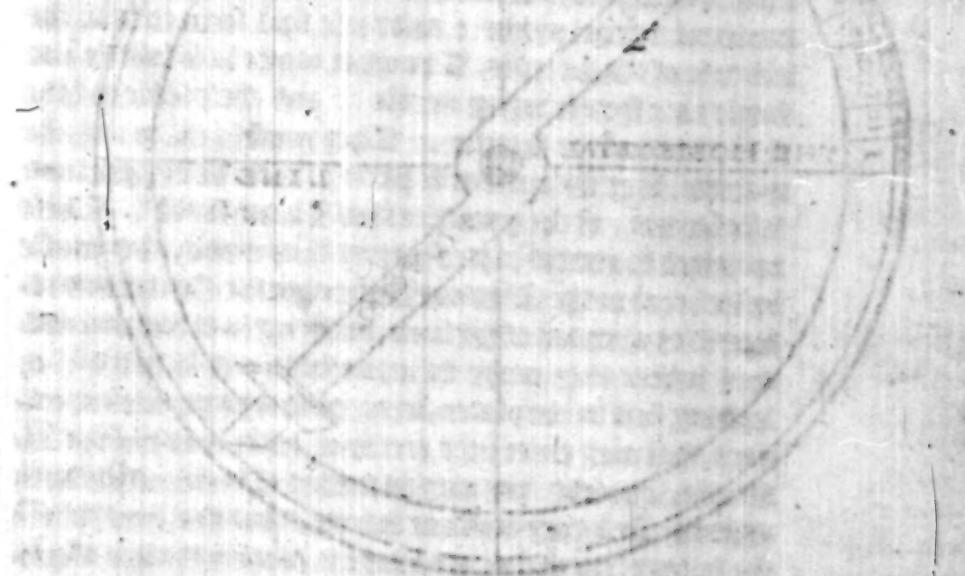
The thirde parte.

tablettes or plates of the same metall wherof the Astro-
labie is made, and of the selfe same thickenesse that is the
Albidada, or little lesse: and of the breadth of the Diam-
eter of the circle of the Albidada. And let them be a thumbe
in heught or breadth. In the myddest of these two pla-
ces, by the heught, you shall make a lyne. When these
are made equal, and al they; angles ryght, in euerye lyne
of these that you haue made, you shal also make two ho-
les, equally distant from the sydes or edges of the sayd
The holes of plates or tablettes. And of the two holes of euerye of
the Albidada. these lytle plates, the one hole muste be as bygge as maye
conteyne a great pynne: and these shal serue to take the
altitude of the Starres. The other muste be so subtle and
smale as a syne sowyng needle: and these serue to take
the altitude of the Sunne. They muste be made in such
manner, that the outwarde parte of them be bygger, and
lesse within, of the quantitie that I haue sayde. These
tablettes or erected plates byng thus made, they muste
be sothered in the Albidada, betweene the Center and ex-
tremities or endes of the same, makynge in it certayne not-
ches where they maye be made faste, and sothered: or
leaving first in the plates, certayne sharpe poyntes or cor-
ners, that may enter into certayne holes made in the Al-
bidada, whereby they may be made fast vnderneath with
pynnes: And they muste be so sette, that the lyne where
the holes of the plates are, maye fal vppon the line of con-
fidence of the Albidada: So that the one halfe of the plate
be set vppon the Albidada, and the other halfe without
it, or at large. In lyke manner shal you take good aduer-
tisement, that the greate hole of the one plate, stande di-
recly agaynst the great hole of the other plate, and be no-
thing at al a wrye. This done, you shal boore the Astro-
labie through by the Center, makynge a very rounde hole,
that may haue in the midst of it the Center of the Astro-
labie. This hole shalbe of the byggenesse of a Goose quyl.
And the lyke shal you make in the Center of the Circle
of the Albidada. Then shal you make a pynne or nayle
of the same laton, the whiche on the upper parte of the
Albidada maye haue a playne and rounde head. This
pinne

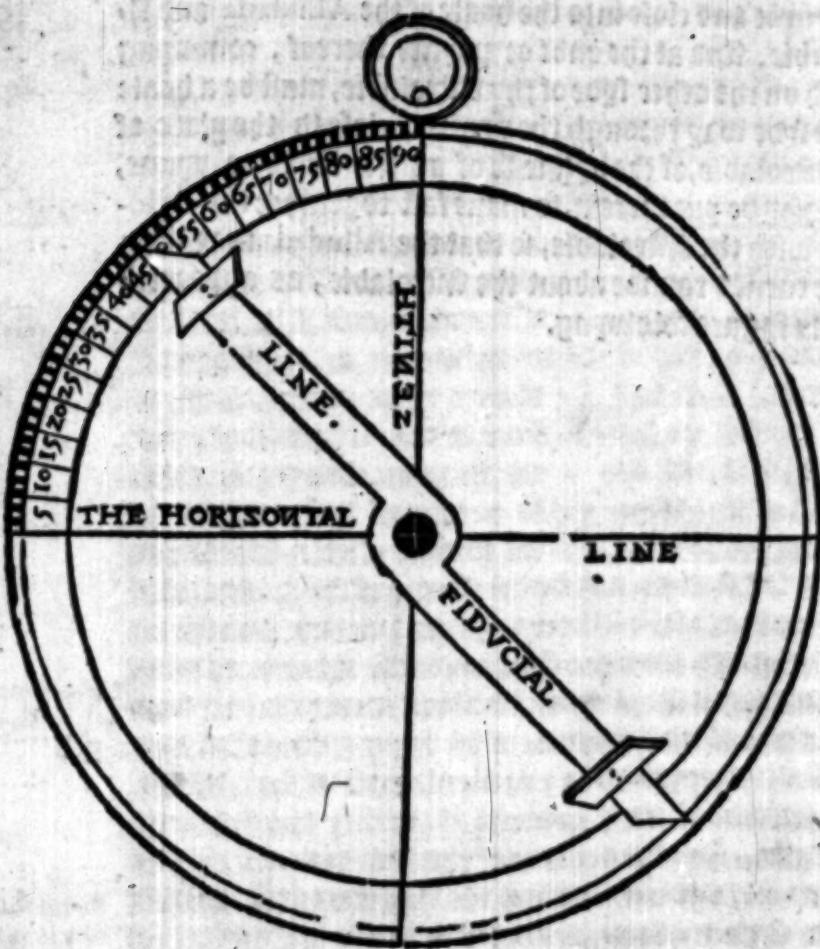
The third parte.

Fol. lxx.

pynne also shalbe very rounde and smooth, that it maye
enter fulle and close into the boale of the Alhidada and A-
strolabie. And at the ende or poynte thereof, commyng
soorth on the other syde of the Astrolabie, must be a boale
made syde way through the pynne, close to the plate of
the Astrolabie, of the bygnesse of a little nayle or pynne,
that may be put therein, to make fast togeather the Alhi-
dada with the Astrolabie, so that the Alhidada may ther-
by be turned rounde about the Astrolabie, as appeareth
in this sygure folowing.



The third part.



To take the
altitude of the
Sunne.

To take the altitude of the Sunne, hang up the Theodolite by the ryng, and set the Alhiciada agaynst the Sunne, and rayse it, or put it downe in the quarter that is graduate, vntyll the beames of the Sunne enter in by the lyttle hoale of the tablet, or raysed plate, and precisely by the other lyttle hoale of the other tablet. Then looke vpon the lyne of confydence: and holwe many degrees it sheweth in the quarter that is graduate) begynnyng from the Horizontal lyne) so many degrees of height hath the Sunne. In lyke maner shall you do to take the altitude of anye other Starre, lookyng through the great hoales,

holes, because this may hardly be seene by the lytle holes,

The. viii. Chapter, of the definition
of the altitudes. And how the altitudes
of the Pole may wel be knownen by
the Meridian altitude & decli-
nation of the Sunne.



It is conuenient to define the altitude, before we gene rules of the use thereof. The Altitude of the Sunne, or the Poone, or of anye other Starre, is the di-stance that is betweene it and the Horizon. And this ought to be accompted by the degrees of the greater Circle, whiche pas-seth by the Zenith, and by the Center of the Sunne, or of the Poone, or of the Starre unto the Horizon. And the de-
grees that are from the Horizon to the Starre, or to the Sunne, that is the altitude: And the degrees that are from the Center of the Starre, or of the Sunne, unto y Zenith, is called the complement, or supplement of the altitude.

what is the altitude of the planets or starres.

The altitude of the Equinoctiall, is ever counted by the Meridian. And the degrees of the Meridian, that are be-tweene the Equinoctiall and the Horizon, is the altitude of the Equinoctiall: and other so many are they, that are from the Zenith to the Pole. For the altitude of the Equinoctiall, is equal to the complement of the altitude of the Pole. The degrees of the Meridian that are bet weene the Equinoctiall & the Zenith, is called the complement of the altitude of the Equinoctiall, and is equal to the altitude of the Pole. And although we haue defined the altitude in generall, yet shal we only profite our selues by the Meridional altitude of the Sunne. The Meridian altitude, is the greatest altitude that the Sunne bath cuerye the sunne. The Meridi-an altitude of

day: and this shalbe, when the Center of the Sunne is in the Meridian. And the Arke of the Meridian, that is be-tweene the Horizon & the sunne, is the Meridian altitude. So that when we say the altitude of the sunnes is taken, it is under-

The third part.

The shadow-
es that the
sunne maketh
at mydday.

is vnderstoode at mydday. The shadowes that the Sunne then maketh, are in thre sortes. For either to vs it casteth the shadow toward the North parte, or toward the South, or perpendicular by a ryght lyne, so that at mydday, or noon, nothyng that standeth upright, geth any shadowe at all. But for as muche as there is such variation in declinations, altitudes, shadowes, and parallelles, it shalbe necessarie to geue rules for all variations. And these shalbe reduced into fourre brefe and compendious rules: the whiche I haue here described, that the wyttie may take profite by them, and the rude learne them: not carrying so the rules of the Maryners, because they are to long and tedious. For (as the Philosopher sayth) it is vaynely donne by many, that may wel be donne by fewe.

The perpendi-
cular shadowe

When the shadowe shalbe perpendicular, it is because the sunne is in the Zenith, 90. degrees aboue the Horizon. And then how many degrees of declination the sunne hath, so muche shall we be distant from the Equinoctiall, toward the part where the sunne declineth. And yf it haue no declination, it and we shalbe vnder the Equinoctiall.

The declining
shadowes.

But when the sunne and the shadowes shalbe to vs from the Equinoctiall, towarde one of the Poles, we shall take away the declination from the meridian altitude, and then shall remayne the complement of the elevation, whiche complement being taken from 90. degrees, then shall remayne that whiche we be distant from the Equinoctiall, towarde the same Pole.

When the sunne declineth from the Equinoctiall, towarde the one pole, and the shadowes shalbe toward the other, we shall ioyn the declination with the Meridian altitude. And if al come not to 90. then subtract them from 90. degrees, and we shal haue the complement, so muche shall we be distant from the Equinoctiall, towarde that pole to the whiche the shadowe falleth. And yf they be moe in number then 90. then the overplus of 90. shall we be distant from the Equinoctiall, towarde the pole, whiche the sunne declineth. And yf they be just 90. we shalbe vnder the Equinoctiall.

When the Sunne hath no declination, we shalbe distant from

Rules for all
variations.

from the Equinoctiall the complement of $\frac{1}{2}$ Meridian altitude, toward the pole where the shadoives are. By these rules (besyde the vse wherof we haue spoken) may be knowne how much is the greatest declination of the Sunne, the altitude of the Equinoctiall, the day, houre, & minute, when $\frac{1}{2}$ Equinoctiall was: the which is knownen as foloweth.

Hauyng taken the greater Meridian altitude of the Sommer (whiche is in the beginning of Cancer) and the lesse of Wynter (whiche is in the beginning of Capricorne) taking away the lesse from the moxe, the restis that, Sunne. To know the greatest declination of the Sunne.
that is from Tropike to Tropike, and consequently par-
ted by the myddell, is the greatest declination. As for ex-
ample: I supoppose, that being in the Citie of Cadiz, to
synde the greater Meridian altitude of the Sunne (being
in the beginning of Cancer) to be .77. degrees, and the
lesser Meridian altitude (which is, when the Sunne is in
the beginning of Capricorne) to be .30. degrees, then ta-
kyng .30. from .77. remayne .47. degrees: and so muche is
from Tropike to Tropike. And the halfe (whiche is .23.
and a halfe) is the greatest declination.

Consequently the greater declination added to the lesse
Meridian altitude, or takyng it away from the greater
Meridian altitude, that ryleth thereof is the altitude of
the Equinoctiall. Example. 23. and a halfe of the greatest
declination, synde with .30. of the least Meridian altitude,
or taken away from the .77. of the greatest Meridian alti-
tude, remayne .53. degrees and a halfe, whiche is the alti-
tude of the Equinoctiall, in the Citie of Cadiz. Example
foloweth, that when we shall take the Meridian altitude
in .53. degrees and a halfe, that day is the true Equinoctiall.
But if one day it had lesse, and the other day folowynge
it had moxe, we must take the lesse from the moxe,
and fourme the rule of thre, vpon the rest, saying, Is. 24.
minutes (which is that that the Sunne declineth in one
day) doth yeeld .24. hours, how much shal those minutes
that lacketh of .53. degrees and a halfe of the altitude of
the Equinoctiall, yeeld me? Multipliying and diuiding ac-
cording to the foresayd rule, then that which cometh ther-
of, halve the houres after midday, when it is Equinoctiall.

Example

The thirde parte,

Example.

Example of the experiance that I made in the Cittie of Cadiz the tenth day of Marche at midday or bygh noone. I toke the altitude of the Sunne, in .53. degrees and .26. minutes: they lacke to be the Equinoctial. 4. minutes. An other day, the xi. of Marche, at noone, I toke the Sunne in .53. degrees, and .50. minutes: which are more then the Equinoctiall by .20. minutes. Then to knowe at what houre the Sunne was in the .53. degrees, and .30. minutes of the Equinoctiall, I toke away the Meridian altitude that I toke at the tenth of Marche, from that that I toke at the xi. whiche is the difference .24. minutes, and I formed the rule, saying: yf .24. minutes the Sunne dyd ryse to me, in .24. houres, then in howe much tyme shall ryse vnto me the .4. minutes that sayled me at the tenth of Marche: I multiplied, diuided, and founde that in foure houres: and so shall you say, that the Equinoctiall was in the citie of Cadiz the tenth day of Marche, at foure of the clocke at after noone: Whiche is vnderstood (accordyng to the Astronomers) at foure houres runne at the xi. day of Marche, at this present yeare. 1545.

¶ The ix. Chapter, of the makynge of the Crosse staffe, wherewith the Mariners take the Altitude of the North Starre.

Make a square staffe or yarde, of the thyckenesse of a synger, more or lesse, accordyng to the goodnessse of the wood, and of length syre spannes or more. For the longer that it is, the more precise shal it be, and the degrees shalbe y greater, wherby foloweth the certayntie of the Altitude. Then take a very playne table, of the length of the staffe, and two spannes of breadth, or at the least a spanne and a halfe: and in the myddest of this table, make a ryght lyne by longitude, and in the one ende of this lyne, make an other lyne that may cut it in ryght angles. And vpon the cutting of these two

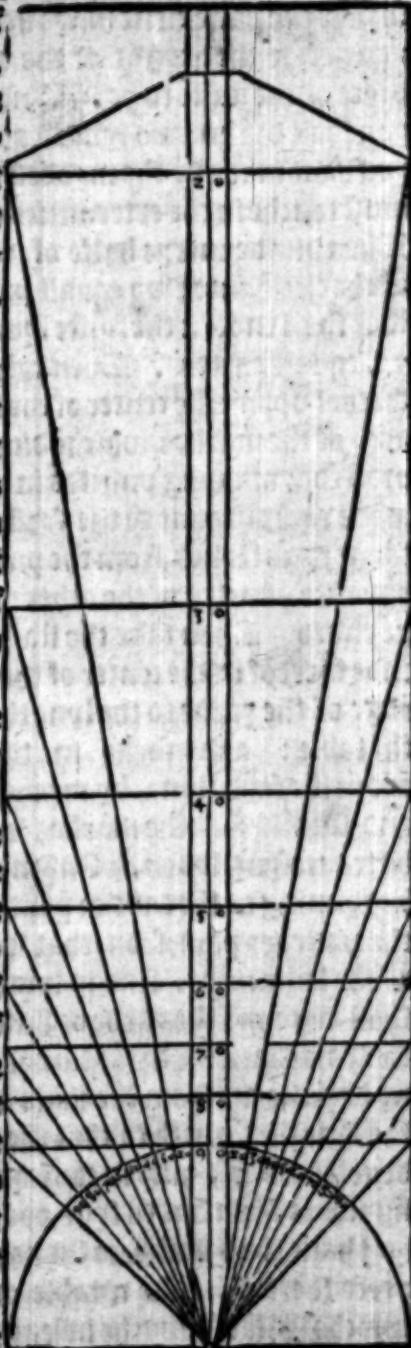
two lynes, put the foote of the compasse, and make halfe a circle, which may remayne on the part of the long lyne, so that the halfe circle maye haue somuche Diameter, as you desyre the heyght of the Hammer, heade, or crosse-peice of the stasse to be. This halfe circle beinge made, you shall draue two lynes, equidistant to the line which you haue made by the myddell of the Table. These lines must touche in the extremities or endes of the halfe circle. Then diuide euerye halfe of the halfe circle, or quarter of the circle, into two equall partes, and the two halves that shall ende in the sy:ste lyne, diuide each of them into 90. equall partes. Then take a ruler, and put the edge thereof vpon the center of the halfe circle, and vpon e: very of the markes whiche diuide the 90. partes: and so procede, makynge punctes in the lynes, whiche you haue made equidistant to the sy:ste lyne. Then draue certayn ryght lynes, from the punctes of the one lyne, to the opposite punctes of the other: and so shall the draught be ended. Then take the stasse or yarde, and put the one ende thereof in the center of the halfe circle, and apply the edge of the yarde to the lyne that goeth by the myddell of the table: and marke in the yarde the markes that are in the sayde lyne, by meanes of the trauersyng lynes, and see also that the markes whiche you make in the yarde, be trauersyng lynes. And make them they: numbers, begynning at the ende or poynct of the yarde that shalbe to the contrary part, from that whiche you dyd in the punct of the halfe circle. And to knowe with what degrees you shall begynne the yarde or stasse, and what number you shall marke in the sy:ste line of the punct, looke howe many degrees are from the circle whiche you diuided betwene the lyne that goeth to the lasse marke, and with so many degrees enter, and so consequentlie shall you place the numbers from nine to syue, or from tenne to tenne. When you haue thus numbered the yarde, then to make the crosse peice thereof, take a table or planke of good wood, whiche shalbe so muche in length, as shalbe the Diameter of the halfe circle, and so muche in breadth as threetymes the thickenesse of the yarde, and of thyckenesse two syn-

The thyrde part.

gers or little losse. On the one syde also it must be very playne, and on the other syde in the myddest, it must haue a square or quadrature of al y thicknes of the plank, and from the square to the ends, it must be made thinner and thinner, so that it haue in maner the forme of such pickars wherewith millstones are picked. And in the midly (by longitude and latitude) it must haue a square hoale, by the whiche the yarde may enter full, & make ryght angles with the crosse pece. And the point of the yarde must enter by the plaine syde of the crossepece, & come forth of the square side thereof.

To take the altitude of the starres.

To take the altitude of the poorth starre, or any other starre on the sea (for it serueth not on y lande nor for the sunne, except the sunne halbe vnder anys thinne cloude, & the horizon cleare) you shall put the heade of the slate to the corner of your eye, raysing it vp, or putting it downe, vntil the nether part of y crosse pece come with the horizon: and being so, if the higher part of the crosse pece shall come with the starre, you muste looke the playne syde of the crosse pece in what number



of degrees of the staffe it falleth, and those degrees shall be the altitude of the starre: as, ys the crosse peice reache not to the starre, you must byng the crosse peice nearer to your eys, vntyl the one part therof come with the horizon, and the other with the starre, & the degrees whiche it sheweth, shalbe the altitude.

The x. Chapter, of the altitude of the Pole,
knownen by the altitude of the North starre.



D know the paralel in the whiche the shipp is, ouer and beside the rules here before of the altitudes of the sunne: it is lykewise knownen by the altitudes of the North starre. These two man-
ners are vsed, soz that more credite is geuen to two witnessses, then to one.

So that if by one arysse any doubte, y same may be certified by the other: and also because time may sometime serue for the one, and not for the other. As, to haue a cloude my-
day or noone, and a cleare nyght.

The altitude is taken of the North starre, whiche is a starre in the extremtie or ende of the tayle of the lesse Beare, being a constellation, commonly called the Horne. For this North starre (of the most notable starres about the Pole) is nearest vnto it, and shall therefore shewe a lesse circle then any of the other, and so shall his altitude differ little from the altitude of the Pole. This starre bath declination 85. degrees, and 51. minutes: and the complemente to 90. (whiche are 4. degrees, and 9. mi-
nutes) is his distaunce from the Pole. And although the maryners holde opinion, that it is not distaunce more then thre degrees and a halfe, yet to my iudgement, more credite ought to be geuen to the Astronomers, then to the maryners: for as muche as the Astronomers doo knowe the places of the starres, with theye longitudes, latitudes, declinations, and right ascensions, more perfectly & precisely then doo the Maryners. For theye accompte not onely by degrees, but also by minutes and secondes. But let none deceave them selues through my opinion.

The thirde parte.

Therefore, whosoever wyll precisely knowe it, let hym take the hyghest altitude of the North starre, whiche is, his being ouer the Pole: and the lesse altitude, whiche is his beyng vnder it. Then take awaie the lesse from the more, and the halfe of that that remayneth, shalbe the distaunce of that starre from the Pole of the worlde. And lykewylse by this experiance, may be knownen the altitude of the Pole, and what all the other starres that goe not downe vnder the Horizon, be distant from it. Joynynge the greater altitude with the lesse, and that shall amount thereof, diuided by the halfe, shalbe the altitude of the Pole: and takynge awaie this altitude of the Pole, from the greater altitude of the starre, or the lesse from the altitude of the Pole: the rest that remayneth, shalbe the distaunce of the starre from the Pole. And as the Pole is inuisible, it can not be scene or knownen, when the North starre is hygher or lower, excepte it be by the meane of some other marke: and so; this is conſidered the position of the former guardes or watch, beynge one of the two starres called the guarde, whiche are in the mouth of the Horne. The marynars haue noted eyght positions from the former guarde starre, to the North starre, whiche aunswere to the eyght principall wyndes. And as the guarde is to the North starre according to the placeyng of these positions, so shal it be higher or lower from the Pole. Let vs here put the common rules whiche the marynars vse, to complie with those that are of opinion of the three degrees & a halfe. And for the opinion of the Astronomers (whiche is the distaunce of 4. degrees, and 9. minutes,) I wyll hereafter geue a circular figure with a mooueable horne: then the eyght wyndes of the eyght positions being marked, and puttynge the guards and the North starre in every of the wyndes, it shalbe the distaunce that the North starre is hygher or lower from the Pole.

Common Rules.

The former guard beyng in the East, the North starre is in one degree and a halfe vnder the Pole.

The

The Pole is
inuisible.

The two
starres called
the guardes of
the north star.

Common
rules of the
marynars.

The Guarde being in the Northeast, the North starre is three degrees and a halfe, vnder the Pole.

The Guarde being in the North, the starre is three degrees vnder the Pole.

The Guarde in the Northwest, the starre is halfe a degree vnder the Pole.

The Guarde in the West, the starre is one degree and a halfe aboue the Pole.

The Guarde in the Southwest, the starre is three degrees and a halfe above the pole.

The Guarde in the South, the starre is three degrees aboue the Pole.

The Guarde in the Southeast, the sayde North starre is halfe a degree aboue the Pole.

Note that these eyght wyndes, are made accordyng to fourt lynes. Whereof two are ryght, which are North and South, and East and West: and the other two are crooked, which are Northeast Southwest, and Southeast Northwest. When the Guarde and the North starre shalbe in the ryght lyne, it shall appeare cleare how they are: and when they shalbe in the crooked lynes, it may be seene, because the Guardes are the one by the other in a ryght lyne.

To see by Theorike or Speculation, howe the North starre ryseth vp, and goeth downe from the pole of the wold, I wyll here describe the sayde circuler figure or instrument, which is a circle in whose circumference are written the eyght wyndes. The North in the hyghest place of the instrument, whiche they call the heade, and the South in the neather part therof, whiche they cal the foote: the East in the ryght arme, the West in the lefste arme, the sours rest, betweene these in their places. And here is to be noted, that the lynes whiche passe not through the center, are of the wyndes of their equidistances, that passe through the center. Within this circle, is an other little circle, whiche describeth the starre of the North, by the mouyng of the syste moveable, and hath so; his center the pole of the wold, as bath the syste. This lytle circle hath so; his Diameter eyght de-

The eyght
principall
windes accor-
ding to fourt
lynes.

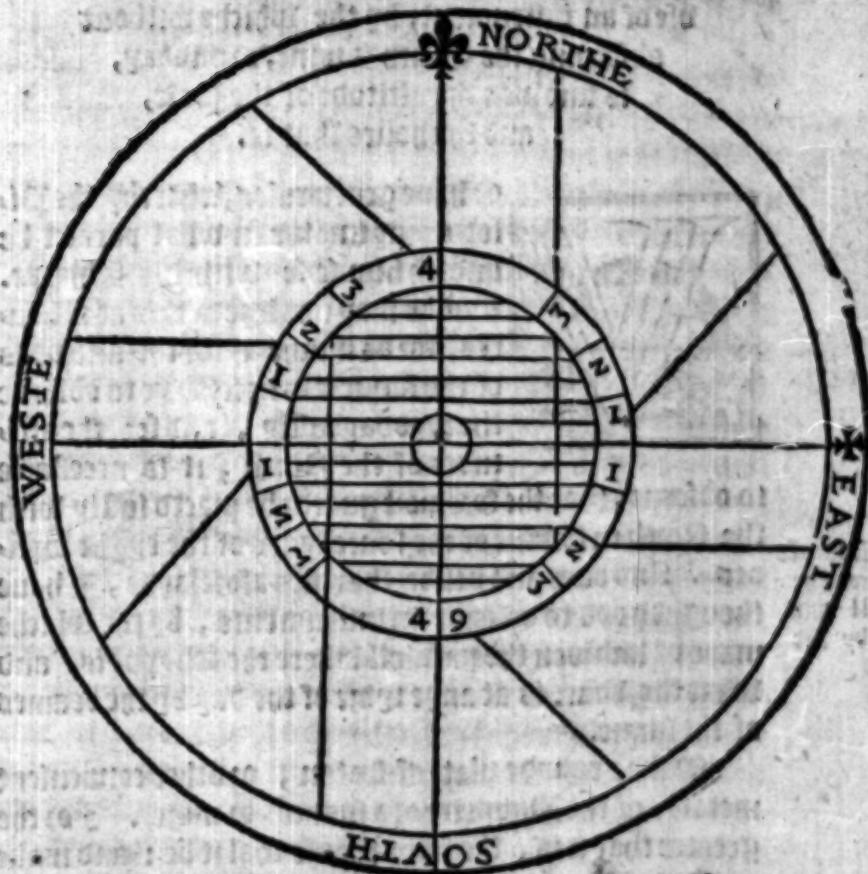
In instrumēt
to knowe the
rysing or fal-
lyng of the
North starre
from the pole
of the wold.

The thyrd e part.

The horne of
the seuen star-
res.

Advertisement
to mariners.

grees and eyghtene minutes : as four degrees and
nyne minutes aboue the pole , and the other four de-
grees and nyne minutes vnder it . And they are diuided
by certayne lynes equidistant to the East and West . In
the center of this circle, is annexed a horne, with his seuen
starres, mouable rounde about by all the wyndes.
And seeing them in heauen, holwe, and in what wynde
they are, euens so in this sygure shall we see the North
Barre , in what part it is of the degrees hygh or lowe
from the pole : and that the Pylotte or Mariners shall
not erre, I say that he ought not to put the fozeugarde in
the wyndes that passe through the center of the sygure,
for it shalbe North and South with the pole , and not
with the starre of the North , as it ought to be, and so of
the other wyndes. And in this manner the starre of the
North, shall shewe in the lynes equidistant from the lesse
circle, the degrees & partes of degree that it is higher or
lower then the pole of the worlde: for the same course, dis-
ferences, and variations, it maketh in heauen.



Thus beyng knownen howe muche the North Starre is
under or aboue the Pole, let vs take the altitude thereof:
and that of it that is under the Pole, let vs toyne to his
height: and as muche of it as is aboue, let vs take away:
and that shall rysen thereof, halbe the altitude of the Pole
aboue our Horizon.

X viii

The

The thirde part.

The xi. Chapter, of the composition and
use of an instrument, by the whiche without
obseruing the South Sunne, or midday,
is knownen the altitude of the Pole,
and the houre that is.



I haue given rules, whereby the Ps-
lotte may knowe in what paralel he
findeth hym selfe with his Shyppe.
But he may not know this at al hou-
res, for as muche as for the altitudes
of the sunne it is necessarye to obserue
the mydday iustly, and for the alti-
tudes of the North, it is necessarie
to obserue, that the foremost guarde be placed iustly with
the North in somme of the fourre lynes of the eyght wyn-
des. And ouer and beside the rules aforesayde, I haue
thought good to describe an instrumente, by the whiche
maye be knownen the paralell where the Shyppe is, and
what the houre is at anye tyme of the day by the beames
of the sunne.

Take a rounde plate of Laton, or other convenient
metall, of the Diameter of a spanne, or more. For the
greater that it is, the more precise shal it be: and make
in it two Diameters, that maye cut them selues in ryght
angles vpon the center: In the fourre extremes, or endes
of these Diameters, leaue fourre rounde punctes or pom-
tes, that may serue for axes. The one of these Diameters,
shalbe called the axes of the worlde: and the other, the
lyne of East and West. This done, make of the same la-
ton a semicircular peece, of the thycknesse of the plate, or
lytle lesse, and of the breadth of halfe a finger, this
must stande vpon an edge, so that the conuer parte maye
come iustly with y halfe of the circumference of the plate,
to the whiche it must be nayled or sothered in the neather
part of the plate, the semicircle being raysed, and that the
endes thereof may come with the endes of the axes of the
worlde. And this semicircle shall you divide into two e-
qual partes, and every halse into 90. degrees, begynnyng
from

In instrument
to knowe the
paralell and
houre by the
sunne.

from the halfe poynte towarde the ende of the axis of the worlde, whiche are the poles.

In like manner shall you make two circular pieces, of the bignesse of a peere of fourt ryals of plate, whiche they cal rundels, for the houres: these muste be made faste in the plate by the Poles of the worlde, whiche maye holde or beare them by their centers. And euerye of these rundels must be diuided into 24. equall partes, and although not al, yet the uppermoste parte of the plate. And aboue in the highest poynte of these diuisions, you muste wryte 12. because that there it shall shewe the mydday or noone. And from thence, the afternoone houres muste begynne they numbers towarde the West part, and shal ende 6. houres in the halfe or myddell of the ioynt of the circell with the plate. In the other ioynt of the other parte, shall beginne 6. of the houres before noone, and shall ende 12. in the highest poynt. You must also make another Demicircular peice, of the breadth of a finger, this muste be playne or flatte, and the concavitie or holownesse thereof, equall to the Demicircle of the edge or side of the plate, and in the endes muste haue two holes, wherein maye fustly enter the poyntes that come soorth of the circell, for the houres, whiche are the Poles of the worlde. Also, this Demicircle must haue two lynes, one, on the uppermost part, and the other, on the neathermost, which maye diuide the breadth into two equall partes. This halfe circle lykewyse muste be diuided into two equall partes by longitude, with a traversed lyne, whiche shalbe called the Equinoctial: and from this lyne, to the inward parte thereof, muste be counted 23. degrees and a halfe towarde the one parte, and as muche towarde the other parte of the 90. that euerye halfe of the circell conteyneth. And at euery part where ende the 23. degrees and a halfe, make a traversed lyne, so that from the one to the other, may be 47. degrees. And in this space shall you drawe certayne lynes equidistant with them of the myddell, that they and the myddle lyne, maye diuide into 4. equall partes the breadth of the halfe circell. Then looke in the table of the declinations of the sunne, what declination

The thirde part.

on haue the 5. degrees of Aries, and that shall you account from the Equinoctiall towarde the one parte, and as muche more towarde the other, makyng a lyne that maye trauerse that of the myddest, where that declinacion dooth ende and touch in the other two lynes. And the same shall you doo at 10. 15. 20. 25. and 30. whiche is the ende of Aries, and beginnyng of Taurus: and then the lyne shall trauerse all the breadth. The lyke also shall you doo to Taurus and Gemini: then in the spaces, write the caracters of the. rii. signes, begynnyng Aries from the Equinoctiall, towarde the North Pole. And then doo Taurus and Gemini ende in the greatest declination, begynnyng Cancer in the other parte of it. Then Leo and Virgo doo ende in the Equinoctiall, where shall beginne Libra, Scorpio, Sagittarius: And in the other parte, Capricornus, Aquarius, and Pisces, shall ende in the Equinoctiall where Aries beganne. This halfe circle must haue an openyng, or open place, even and iuste in the myddest from the Equinoctiall, vnto some what more then the greatest declinations: and muste be a litle bwoader on the inner parte, then without, and not so bwoade as may come to the two lynes, because it woulde then take away the graduation of the signes. And in this open place muste be put a square grayne or stubbe, whiche on the inner parte maye come playne with the halfe circle, and on the outer parte maye come soorth a litle, where shalbe nayled a square peece of Laton, of the breadth of the halfe circle: This grayne or stubbe being so nayled with the peece, must haue in the myddest a hole, so smal, as maye receaue a lytle pynne: and by the center of this hole, must passe a lyne, whiche shal trauerse all the grayne. And this lyne shal serue to put the sunne, (whiche the hole representeth) in the degree of the signe wherolt is. This halfe circle where it goeth in the circumferencies of the rundelles for the houres, muste be syled on the one side vnto the lyne that is in the myddest, to marke it, and shew the number of it. For the placcyng or settynge of this instrumente, you muste cut a gyrdell or ryng.

The caracters
of y. xi. signes.

The hole that
representeth
the sunne.

The placcyng
or settynge of
the instrumente.

ryng of laton, as thicke as the plate, and of the breadth of a finger, or lytle lese: and so large, that of it maye be made a circle somewhat bygger then the plate, so that the plate and the Meridian maye easly be conþepned within it. This circle shalbe called the Horizon, which must be diuided into four quarters.

In lykemanner muste be made two semicircular peeces: and the endes of them must be nayled or sothered in the poyntes that diuide the quarters of the circle: and diuide the one from the other in two equall partes, making ryght spherall angles. And in this synt of these two peeces, muste be nayled or sothered a Mastell, the whiche at the one ende is diuided into two banches or sozkes. Then shall you make a base or foote for the same, which in the uppermoste part thereof, shall hane a concanitie or holownesse, where maye be sette a saylyng compasse or a needle, touched with the Lode stone, and couered over with a glasse. And on the hyghest edges of this base, the two banches of the Mastell shalbe made fast: to this Base, with the Mastell, the halfe circle, and the circle, shall be all one pece, whiche shalbe called the stae or frame of the Instrument. The Horizontall circle in the endes of one halfe circle, muste have two hoales, in the whiche may enter the Aris that are made in the endes of the lyne of East and West.

Also you must take good heede when you sother or make faste the Mastell in the Base, that the North and South of the plate or Horizon, come with the North and South of the needle that is beneath: haþyng euer respect howe muche the needle doeth varye from the Meridian, by North eastyng or North westyng. In the synte of the two halfe circles vpon the Mastell, muste be a poynt (called the Index or shelver) whiche shall shewe in the halfe circle, sothered in the plate on the neather parte, the degrees that the Pole is rayled aboue the Horizon.

The foote or
Base of the in-
strument.

The Index
or shelver.

The thyrde parte.

The placynge of the Horizo.

For the perfection of this instrument, it shalbe conuenient to set the Horizon very playne & equall at the time of the operation or practisynge with the instrument: and this may be done in two maners. Whereof the one is, hangynge by a fine thred, at the center of the plate, a plomet made somewhat poynted at the neather ende: so that the Horizon standynge playne and leuel, the poynt of the plomette maye fall vppon the poynt of the index, and this maner is good for the lande. But for the Sea, you shal soother in the Horizon two Ares, little stubbes or endes commyng foorth. These shalbe put in the two opposite boales of a circle of metall made somewhat strong, and this circlemesse haue other two stubbes lykelwysse commyng foorth, and equally distant from the two boales. These muste be sothered or nayled in two boales of an other circle in lyke maner, and the other circle with other two stubbes, inclosed in a bore. If then the bore stand even and leuell, the poyle or wayght shall cause the Horizon to stande leuell, although the shyppe sway or roule from syde to syde. The use of this instrument is in this manner.

The use of the instrument.

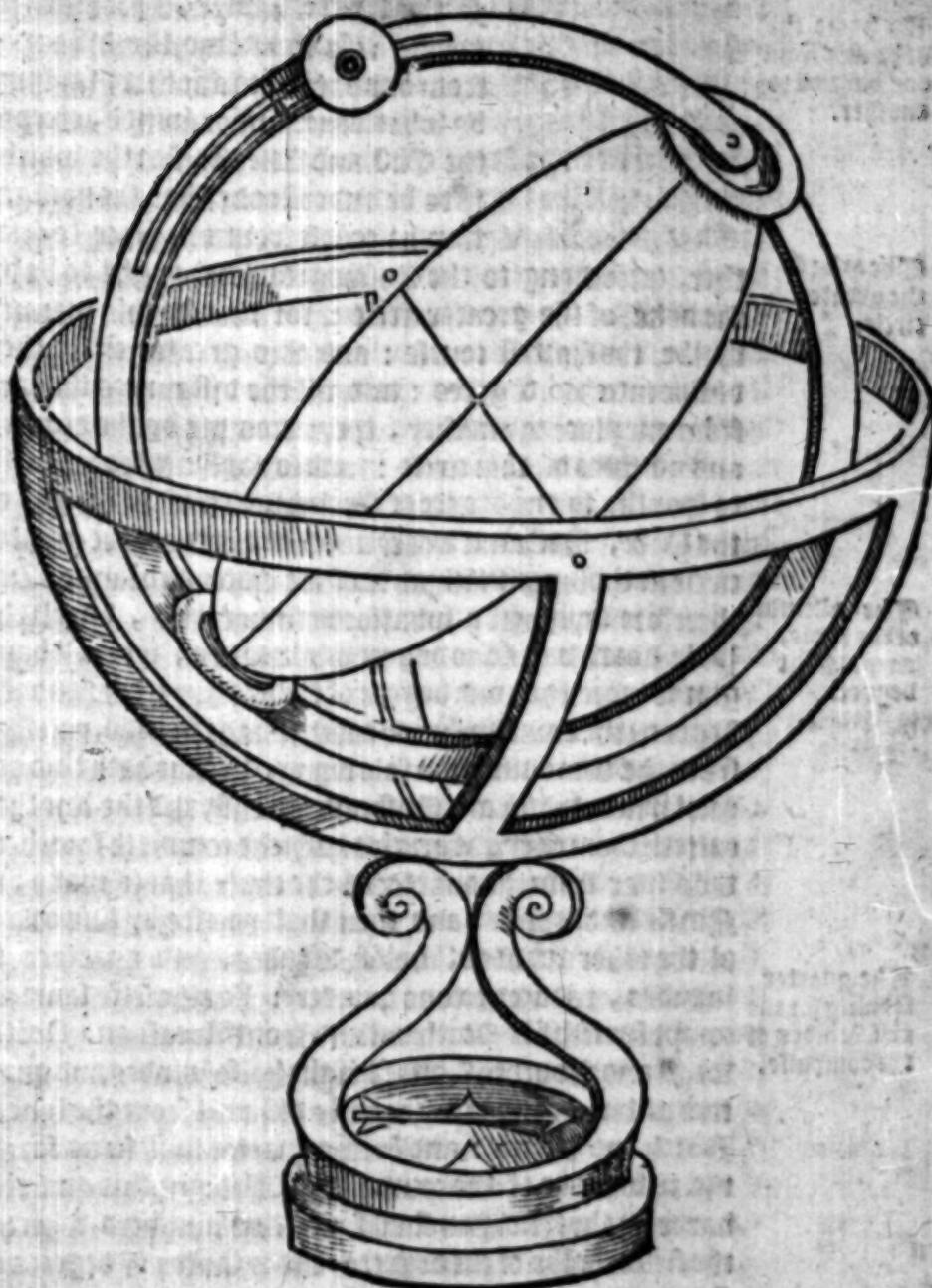
When you desyre to knoile the paralell in the whiche you are, and the houre that is, put the lyne that trauerseth the grayne, in the degree of the signe in the whiche the Sunne is (whiche you shall knoile by the table of the place of the Sunne, in the seconde Chapter of the seconde part) and set the North and South of the plate, with the North and South of the needle. Then turne the moueable Meridian agaynst the Sunne, the foote of the instrument standynge faste: and rayse it, or put it downe in the plate, vntyl the beame of the Sunne enter in at the boales of the grayne, and fall in the center of the plate: and standynge so, beholde the index, and howe many degrees it sheweth from the Meridian, so muche is the altitude of the Pole. Then looke where the moueable Meridian sheweth in the rundell of the houres: and there shall you see the houre that is.

The altitude of the pole.

The thirde part.

Fol. Lxxix.

Here foloweth the demonstration.



The thirde part.

The.xii. Chapter , of the leagues that are runne for a degree, according vnto diuers courses.

To howe the
distaunce from
one paralell to
another.

The arke of
the greater
circle.

The altitude
of the Pole,
varyng one
degree.

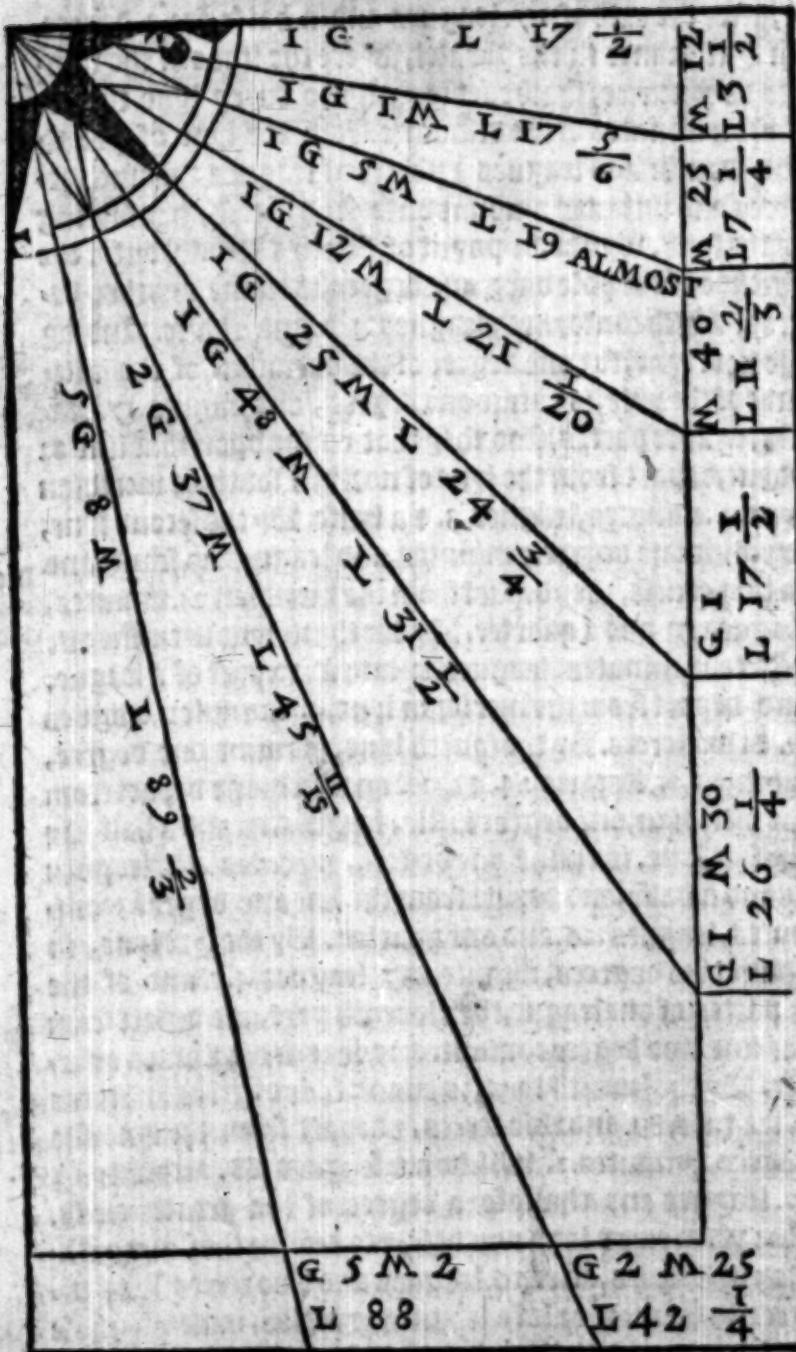
The quarter
seruynge for the
xxii. windes of
the compasse.



So the syrth Chapter , I promised to geue a rule to knowe the distaunce from one paralell to another, saylyng by whatsoeuer line or winde , excepte the East and West: For the whiche is to be vnderstoode, that the nauigation or course from one place to another, (accordyng to the Cosmographers) ought to be by the arke of the greater circle : for that by this manner shalbe the shorstell course : and this greater circle they diuide into 360. degrees : and all the distaunces that are from one place to another , they accompte by the degrees and minutes of this circle : and so saylyng from North to South, to one degree of the vartation of the heyght of the Pole , shall answere another degree of the greater circle in the superficiall parte of the water and lande. And therefore saylyng by whatsoener other lyne , vntyll the Pole dooth varie one degree of altitudes , we shall haue gone more then one degree of the greater circle: and the degrees that answere to every lyne & wynde, you shal see in the demonstration folowyng, whiche hath two paralell lynes, whiche are East and West, and the line that cutteth them in ryght angles, whiche commeth soorth of the center from the quarter of the circle that is made , is North and South , and then shall you see by this order, al the other wyndes, halfe wyndes, and quarters of wyndes , reduced to one quarter : For the selfe same accompt serueth for Northeast and Southwest and Northwest and Southeast, and so of the halfe windes and quarters of wyndes that are equally distaunt from the lyne of North and South : and so this quarter shall serue for all the. 32. wyndes of the compasse . Without this quarter, harde by the lyne, you shall fynde two numbers, whereof the firste shalbe of the degrees, and minutes of degrees of the greater circle, whiche is from one paralell to another. The other number, shalbe the leagues, and partes of leagues

leagues that such degrees and minutes do amount unto, after the rate of 17. leagues and a halfe for a degree. In lyke maner in the paralel, where the lines of the windes do concurre, shalbe set ioyntlye to every lyne the degrees & minutes of the distaunce from the lyne of North and South: and leagues & partes of leagues that such degrees and minutes amount unto. And so it is, that sayling by the lyne, wynde, or poynt of North & South, vntyl the altitude of the pole vary one degree, is runne another degree, which conteyneth leagues 17. and a halfe. And by the next lyne, for one degree of the variation of the altitude of the pole, is runne one degree, one minute. 17. leagues, & 5. syxt partes. And they that runne vpon that line or poynt, depart from the lyne of north, & south, or meridian lyne. 12. minutes, leagues 3. & a halfe. By the second lyne, is runne one degree, 5. minutes, and leagues 19. scant, and Departing in this course, they depart from the meridian 25. minutes, from the meridian line, leagues 7. and a quarter. By the thyrde lyne is runne one degree, 12. minutes, leagues 21 and a 20. part of a league, and depart from the meridian lyne, 40. minutes, leagues 11. & two terces. By the fourth lyne, is runne one degree, minutes 25. leagues 24. & three quarters, and depart from the meridian, one degree iustly, leagues 17. and a halfe. By the syxt lyne, is runne one degree, minutes 48. leagues 31. and a halfe, and depart from the line one degree 30. minutes, leagues 26. and one quarter. By the syxt lyne, is runne two degrees, minutes 37. leagues 45. and of the 15. partes of one league, the eleventh part, and depart from the line two degrees, minutes 25. leagues 42. and a quarter. By the seventh lyne, is runne syue degrees, minutes 8. leagues 89. and two terces, & depart from the lyne syue degrees, minutes 2. whiche are leagues 88. accountynge Degrees of the greater circle. And yf so for every lyne you desyre to knowe this computation of leagues, after 16. leagues and two terces for a degree, or for more or lesse leagues or myles, multiply those such degrees by the number of the leagues or myles which enter into every degree, and lykewyse shall you number the minutes that are more then the degrees, by the same number

The thyrde part.



number of the leagues that ente in every degrees, being dyng them by .6. and that that shal come of the division, you shall ioyne with the multiplication of the degrees, and that shall amount thereof, shalbe the leagues, and partes of leagues, that was in those such degrees.

¶ The xiii. Chapter, howe to set or make a
piche in the Carde of Navigation.



The Maryners cal the pichyng of a poynt

in the Carde, to see and appoynt in it, in what poynt or part of the sea the shippes is
in Navigation, for the performing wher-
of, it shalbe requisite that the pilot knowe
in To knowe in
what part or
poynt the shipp
ing.

from what degree, or howe many degrees of the altitude
of the pole he departed, and with what wynde he sayleth.
And when he desyreth to knowe wher he is, let him know
the altitude of the pole, by somme of the aforesayde
rules. And of talyng the altitude, he synde hym selfe in
the same degrees wher he was when he departed, his na-
vigation bath ben from the East to the West, and what
he bath gonre can not be knowen but by the judgement
of a wise and expert man, according to the swiftnesse or
goodnesse of his shipp, with consideracion of the more or
lesse tyme he bath had, as he hath sayde before in the syrth
Chapter. But if he synd him selfe in more or leſſe degrees, To synde the
let hym take two payre of compasses, and put the foot of distance by the
one, in the poynt or place wher his shipp was when he
departed, and the other in the lyne or wynde by the whiche
he sayleth, and lykewyse let hym set the one poynt of the
other compasse in the graduation of the Carde, in that
number of degres that he syndeth the altitude of the
pole, and the other poynt of the same compasse in the next
lyne of East and West: and so with both the compasses,
one in the due bande, and the other in the other bande, let
hym go ioyning them togeather, talyng good heed, that
the poynt of the compasse do not swarne from the wynde
wherby he bath sayled: neyther the poynt of the other
compasse from the line of East and West, wher he set it.

The altitude
of the pole.

to synde the
distance by the
Carde.

izrael.107
The thyrde part.

And folowing these two compasses by these two lynes, untyll the poyntes of the two compasses ioyne (that is to meane, the poynt that was set in the place from whence he departed, and the other that was set in the degrees that were found) then where these two pointes do ioyne, is the poynt where the shipp is. But (as we haue sayde in the syxt Chapter) they muste haue great respect to the wyndes and seas, and other thynges whiche experiance sheweth them, to knowe yf they haue gon directly by that lyne, or yf they haue fallen from it, and to what part. The whiche I remitte to the iudgement of men of good experiance. From thence forwarde, they shall retorne to keepe the same accounte, as when they departed from the haven, especially when they change their course.

The.xiii. Chapter, of the makynge and vse of
an Instrument generall, to knowe the houres and
quantities of the day, and at what wynde the
sunne ryseth and falleth.



Take a rounde plate with a ryng of a handle abone, as in \mathfrak{h} A strolable, drawynge a lyne from the ryng downward passing through the center, and another lyne that may cut it in ryght angles through the center: And this last lyne shalbe called the Horizon. When shal you gene a circle vpon the center, leauyng so muche space betwene it and the edge of the plate, that therin may be witten the numbers of the degrees: then also make another circle somewhat more within, leauyng lykewyse a space where the graduationis may be vnted: This done, diuide one of the hyghest quadrantes toward the left hand, into 90. partes, whiche shalbe caled the degrees of altitude, beginning the number of them from the ryng, and endyng the same in the Horizon. Then make another rondell somewhat less then this, in such maner that the degrees and numbers of the greater, remayne uncutted. And diuide this less

Jesse, by two Diameters into fourte equall partes. And at the one ende of the one Diameter, leaue a poynt conuenient soorth of the litle rundel, cut directly with the same Diameter by the one parte, and this shalbe called the inner or shewer. In this rundel shal you make a circle halfe a finger lesse then the rundel. Then with a compasse take 23. degrees and a halfe from the Diameter, whiche signifieth the Equinoctiall: and whereas ende the 23. degrees, and a halfe for every parte, make a ryght lyne from one poynt to another, so that this be a lyne of 47. degrees, and as muche more at the other ende of the said Equinoctiall. Uppon euerye one of these ryght lynes, you shall make a halfe circle, and diuide euerye of them into syre equall partes, whiche may aunswere to syre signes, and every signe into three partes, whiche may aunswere to the tenthes or tenth partes of degrees: & if the instrument be great, you shal diuide every signe into five or more partes, so that you may make it perfect & precise. This done, from the poyntes or prickes of the one halfe circle, to the poyntes of the other, drawe certayne lynes which shalbe equidistant to the Equinoctiall. In the endes of these lines, betweene the litle circle & the edge of the runder, draw also certayne lynes which may reach unto the begynnynges & endes of the signes: and in the top of the endes, or out the endes of these lines, make an arcke so farre distaunte from the litle circle, as is by thicknesse of the edge of a peice of fourre rials of plate: And in the space that is least, graduate the signes from ten to ten, or as the diuision shalbe. The space that remayneth from thence to the edge of the runder, you shall diuide by the halfe, & in it shalbe made twelve spaces, where you shall set the signes with theyr names or carraiges orderly, so that Aries be nexte to the Equinoctiall: Then Taurus towarde the part of the Inner: Then Gemini. And turninge towarde the Equinoctiall, Cancer, Leo, Virgo. Lyke wyse on the other parte of the Equinoctiall, Libra, Scorpio, Sagittarius. And turninge to the Equinoctiall, Capricornus, Aquarius, Pisces. And thus having signed the Zodiache, you shall also signe or marke the hours in manner as foloweth. The 30th.

The placeyng
of the xii. signes
in the in-
strument.

The thyrde parte.

Divide the leste circle of this rundel into fourte equall partes, so that every quarter may haue syre partes. Reduce this diuision to the Diameter, putting the ruler vpon the poyntes, equally distaunt from the Horizon. And wher it toucheth the Equinoctiall, make prickes or poyntes, so that the Equinoctiall remayne diuided into twelue partes. Then vpon one of the Tropikes gne a circle, which may haue the same Tropike for his Diameter. Divide this circle into 14. equall partes, and reduce these diuisions to the Tropike, as is donne in the Equinoctiall, from one Tropike to another: then the Equinoctiall and the Tropikes being thus diuided with these prickes or poyntes, you shal passe with a paire of compasses by every poynt equally ordered from the Horizon, to the one and the other part: and these shalbe called houres, wrytyng in the endes of them they numbers, begynnyng the one part in one, and endyng it in twelve. On the other parte,

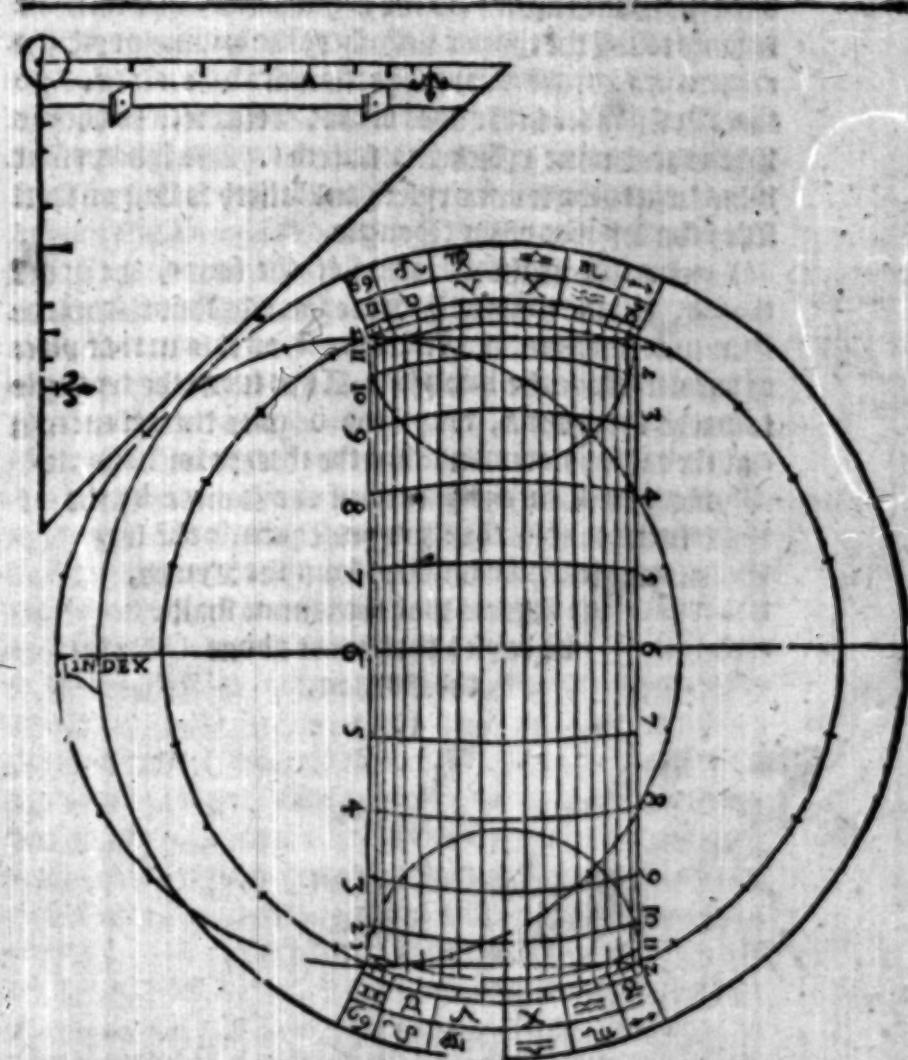
The houres is with they numbers. begynne the one in thopposite parte, and ende in twelve. This donne, these rundels shalbe brought to they perfection. Moreover, you shal make a tryangle, with a right angle, hauing two equall sides that may make the right

The tryangle, angle: Every of these sides must be as long as is the Semidiameter of the greatest rundell: also, vpon and about the right angle, you shal make a little circle, which shall haue the same angle for his center, & on the one side of this tryangle, set two rayed plates, as in the Astrolabie, on the contrary side of these rayed plates, must be a hole, so farre distaunt from the center or angle, as is the Semidiameter of the circle of the leste rundell. In this hole you must put a threede, hanging therat a lytle wayght or plomet, onely sufficient to holde the threede straignt, so that it cause no hing of the rundels to turne, or the instrument to declyne. Furthermore, in a circle as bigge as the leste of the leste rundell, you shall diuide into 32. partes the eyght wyndes, and halfe wyndes, and quarters of wyndes. And being thus reduced to their Diameter (as is donne in the Equinoctiall) you shall translate them in the sides of the tryangle, in the which by the center of his little circle, & by the center of the rundels, al the other pecces must be made

Division of the wyndes.

gaff with an ares o; a maple, so that they may be turned about close & very fast. Then put a ryng in the handle of the instrument, whereby it may hang, as in the Astrolabe: & so shall the instrument be finished & brought to perfection.

This is the trace o; draught of the instrument.



The thyrde part.

Division of
the Equino-
tiall and Tro-
pikes.

The houres
is with theyz
numbers.

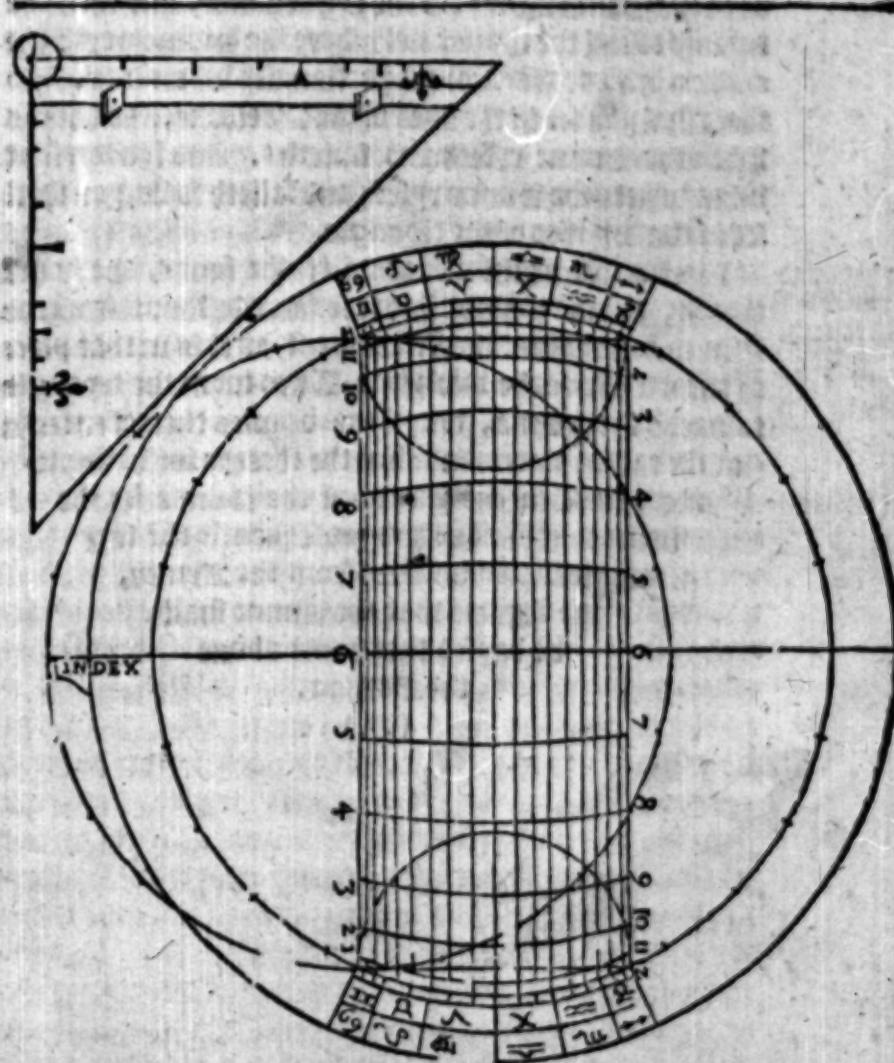
The tryangle.

Division of
the wyndes.

Divide the lesse circle of this rundel into fourre equall partes, so that every quarter may haue syre partes. Reduce this division to the Diameter, putting the ruler vpon the pointes, equally distaunt from the Horizon. And whers it toucheth the Equinoctiall, make prickes or pointes, so that the Equinoctiall rentayne diuided into twelue partes. Then vpon one of the Tropikes gene a circle, which may haue the same Tropike for his Diameter. Diuide this circle into 24. equal partes, and reduce these divisions to the Tropike, as is donne in the Equinoctiall, & from one Tropike to another: then the Equinoctiall and the Tropikes being thus diuided with these prickes or pointes, you shal passe with a paire of compasses by every point equally ordered from the Horizon, to the one and the other part: and these shalbe called houres, wytyng in the endes of them theyz numbers, begynnyng the one part in one, and endyng it in twelve. On the other parte, begynne the one in thopposite parte, and ende in twelve. This donne, these rundels shalbe brought to theyz perfection. Moreover, you shal make a tryangle, with a right angle, hauing two equal sides that may make the right angle: Every of these sides must be as long as is the Hemidiameter of the greatest rundell: also, vpon and about the right angle, you shal make a little circle, whiche shall haue the same angle for his center, & on the one side of this tryangle, set two raysed plates, as in the Astrolabie, on the contrary side of these raysed plates, muste be a hole, so farre distaunt from the center of angle, as is the Hemidiameter of the circle of the lesse rundell. In this hole you must put a thred, hanging therat a lytle wayght or plomet, onely sufficient to holde the thredde straignt, so that it cause no hing of the rundels to turne, or the instrument to declyne. Furthermore, in a circle as bigge as the lesse of the lesse rundell, you shall diuide into 32. partes the eyght wyndes, and halfe wyndes, and quarters of wyndes. And being thus reduced to their Diameter (as is donne in the Equinoctiall) you shall translate them in the sides of the tryangle, in the which by the center of his little circle, & by the center of the rundels, al the thred pecces must be made fast

gaff with an ares or a naple, so that they may be turned about close & very full. Then put a ryng in the handle of the instrument, whereby it may hang, as in the Astrolabe: & so shal the instrument be finished & brought to perfection.

This is the trace or draught of the instrument.



The thirde part.

To knowe at what houre the Sunne ryseth and falleth
the Sunne ryseth or falleth.

To knowe at what houre the sunne ryseth and falleth
(by the instrument folowynge) you shal put the pole of the
leste rundell (whiche is the index) to the leaste hande in
the greatest rundell in so manye degrees aboue the Horizon,
in howe manye degrees the pole is raysed in that
lande or place. Then put the tryangle (whiche is the Ho-
rizon) in his place. That is to say, yf the Sunne shalbe in
the North signes, put it to the leaste hande: and yf it shal-
be in the South signes, to the ryght hande, and then the
tryangle shall cut the paralel where the Sunne goeth, in
10.02.20.02.30. degrees, or proportionally where it is. And
there shal you see in the sides of the Zodiacke, the houres
when the Sunne ryseth and falleth. And lykewise at
what wynde the Sunne ryseth and falleth to vs, you shall
see in the wyndes of the tryangle.

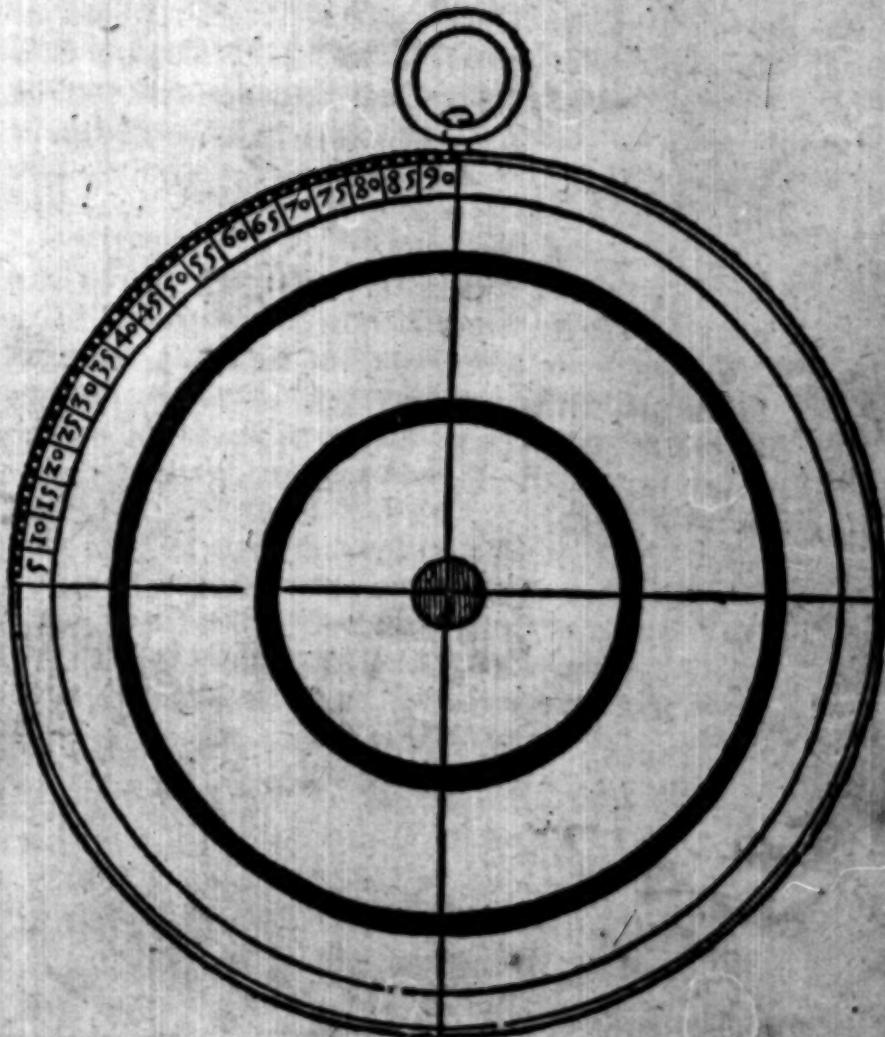
At what wind
the sunne ri-
seth or falleth.

To knowe by the elevation of the sunne, the houre
that is, put the Pole or Index so farre distaunt from the
Zenith or handle of the Instrument, as it is in that place
or paralel aboue the Horizon: Then turne the tryangle
towarde the Sunne, untyll the beames thereof enter in
at the raysed plates, and then the thredes with the plo-
met, shall cut the paralel of the Sunne by the
houre that shalbe: and consequently the try-
angle shalbe distaunt from the Zenith,
the degrees that the Sunne shall
be raysed that houre aboue
the Horizon.

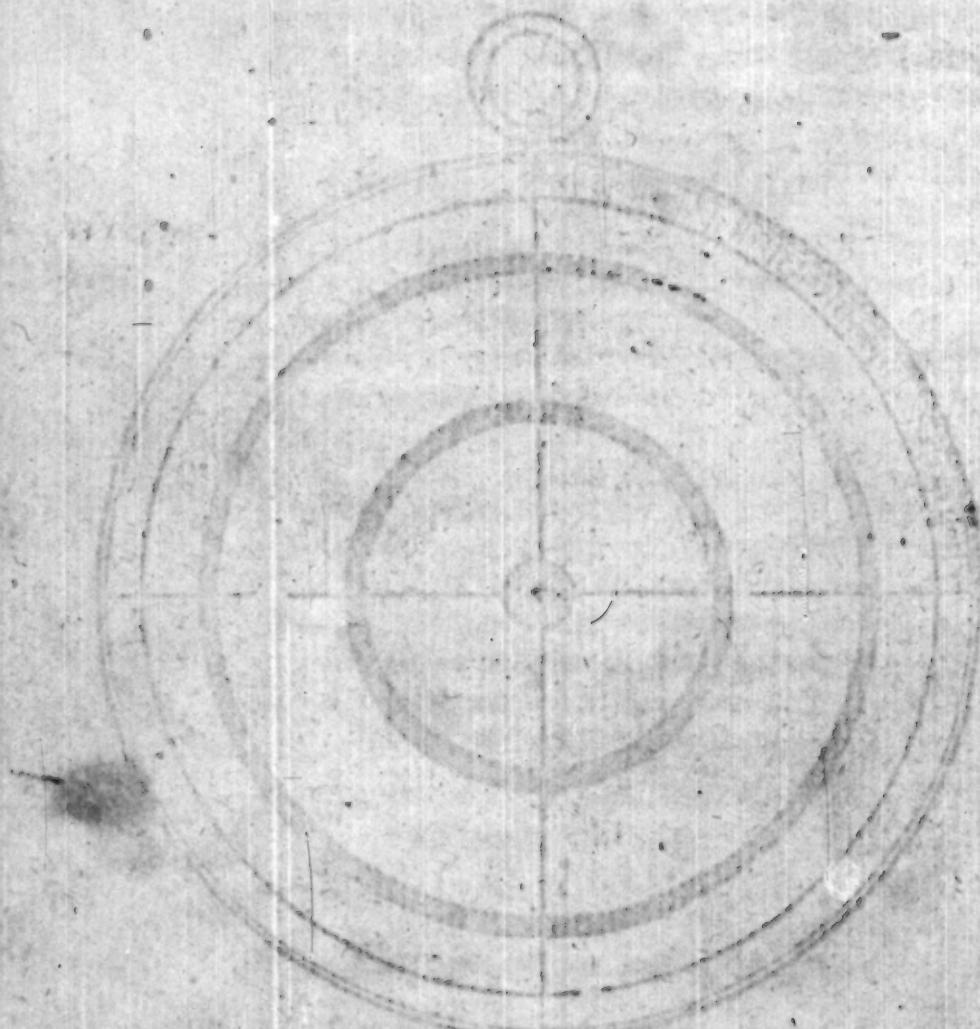
(. . .)

The thirde part,

This is the Demonstration.



FINIS.



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